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STEAM VERSUS ELECTRIC AUXILIARIES.

It is the customary American practice to install steam auxiliaries in large generating steam stations. That is to say, the power required to drive the pumps and fans of the plant is not supplied by motors receiving current from the bus-bars, but by small independent steam engines receiving steam from the main boilers. The reasons ordinarily assigned for this preference are mainly in regard to security and convenience. It is urged that any failure of current at the bus-bars does not involve the stoppage of the station auxiliaries when the latter are driven by independent steam engines. Moreover, if steam is needed for heating the buildings or for other purposes, this steam has to be taken from the boiler main-steam pipes if all the auxiliaries are motor-driven; whereas it may readily be supplied from the exhaust of the auxiliaries, if these are steam-driven. In Europe, on the other hand, the practice varies in this respect. In the most modern central station steam plants there are some which employ all the steam for driving turbines connected to high-tension alternators, and the auxiliaries are driven by direct-current motors, which are supplied from the bus-bars, through step-down transformers and converters, in connection with a storage battery. The storage battery enables the auxiliaries to be driven for several hours independently of the pressure at the high-tension bus-bars.

As regards economy in fuel, it might seem at first sight as though the advantage might lie in favor of the electric drive, since the steam consumption of the auxiliary engines is wasteful by comparison with that of the large turbo-alternators. It is doubtful, however, whether fuel economy can always be secured by the electric drive. The current for the motors has to be supplied after electric losses have been incurred in storage-battery, converter, transformer, and dynamo. The advocates of the electric drive usually admit that there is no claim to be made on their practice for fuel economy. They claim that the electric drive is much the simpler and more reliable. They point out that they substitute copper wires for steam-pipes, and that they are able to reduce the steam-piping of the station to its simplest elements. There is no doubt much to be said on each side of the question, and the selection is likely to depend upon local custom and local conditions rather than on strictly impartial considerations. Almost everyone will admit, however, that the ideal central steam station is one which employs its boilers solely for delivering high-pressure steam to its main engines, and where the auxiliary engines are as few, as subordinate, and as simple as possible.

THE STREET RAILWAY INDUSTRY.

Elsewhere in our pages this week are given details with regard to the programme of exercises in Philadelphia next week in connection with the annual meeting of the American Street Railway Association. The convention in the city of Franklin promises to be one of more than usual interest and importance. It is a great many years since the association visited Philadelphia, and in fact the last meeting there occurred at the very beginning of the great electrical revolution and development which has given such a tremendous extension to the field of the street car. At that last meeting the advocates of electricity were present almost on sufferance. By many of the members their cause was regarded as wild and visionary, and the whole industry then promised long to remain under the sway of the horse and the cable. But as everybody knows, all that has been

changed, the cable has disappeared, the horse has been reduced to a condition of insignificance and electricity reigns supreme. How long the electricity regime may endure no man can tell. The gasoline automobile perhaps challenges the electric street car, but so in a sense did compressed air and steam at one time, while even the bicycle was thought to be in the race. At a time when such radical improvements are still being made in electrical apparatus and systems, it does not seem that we are unduly sanguine in forecasting at least as long a period of supremacy in the street railway field for electricity as steam has enjoyed in the operation of main lines of railroad.

In many ways the Philadelphia meeting this time, like that of 1887, will be a point of new departure for the association. We gave last week the proposed revision of the constitution and the suggested change of name. To electricity alone may be attributed this necessity of reorganizing the association and aligning it to the new conditions and problems of the time. The trolley car has broken through the strict limitations of urban environment and has become the one great vehicle of interurban communication, while it also is rapidly pushing its way upon the steam railroads. Even if it would, the American Street Railway Assoiation can no longer remain an organization of urban corporations, but must take cognizance of its larger actualities, responsibilities and possibilities and place itself in touch for nobler service with the population of the whole country. That the association shows it is ready and willing to do this is the best indication of its continuing influence and prosperity.

In many ways the city of Philadelphia has made a deep impress upon the street railway field, and of late years more particularly on street railway finance. It has been somewhat the fashion to indulge in abuse of the remarkable group of men in Philadelphia that has aggrandized itself by exploiting the street railway systems of many of our leading cities. But after all the personal wealth secured is trivial compared with the incalculable benefit bestowed upon the public, for it is due to their boldness of conception and daring readiness to extend the systems acquired that the industry has been brought up to its present gigantic proportions and has been so distinctively American in its rapidity of growth. Thus once more mere human selfishness has been made by forces greater than ourselves to subserve the common cause of human progress.

THE WIRELESS TELEGRAPH INDUSTRY IN ENGLAND.

One advantage to the English public of public business in England is that the financial particulars of the business have to be reported at stated intervals in such a manner that they are virtually published. In this way anyone's business becomes everyone's business to enquire into, when the work done is a public commodity. There are both advantages and disadvantages in this method of procedure; but it is generally admitted that the advantages preponderate. Last year the British Parliament passed an act requiring that a license should be applied for and received by all persons or corporations seeking to send wireless messages by Hertzian waves. The returns for the first quarter of the present year have now been printed as a Parliamentary paper, and an abstract of the same appears in the London *Electrician* for July 28.

The report shows that 1,655 messages were received into Great Britain from ships at sea during this quarter, by wireless telegraphy; or at the average rate of about 18 daily. The number of messages received in Great Britain for transmission outwards to ships at sea, during the same interval, was 111, or rather more than one each day. Of the latter, 21 messages, or 19 per cent, failed to reach their destination. The report also gives a list of 78 applications made for permission to send wireless messages. The great majority of these applications were for private or experimental purposes, and the long list of these toy wireless systems is of somewhat amusing interest. At the same time it must be admitted that the authorities have not acted in an arbitrary or dictatorial spirit; because, although only 48 of the applications are stated as being granted, yet only one has been entirely refused, and in several other cases where they have been partly refused on the grounds of interference with existing stations, alternative sites have been offered.

THE HEATING OF DYNAMO FIELD-COILS.

A report on experiments with the heating of dynamo field coils at the National Physical Laboratory of Great Britain has recently been published in the *Transactions* of the British Institution of Electrical Engineers. Owing to the fact that the measurements were mainly carried out at unduly high temperature elevations, the value of the report is of indirect rather than of direct interest to electrical engineers. Since, however, it embodies the results of a long and careful series of observations, a number of indirect deductions may be drawn from it to practical advantage. It is well known that there are three methods available for determining the distribution of temperature in an electrically active field-coil. One is to insert thermometers into different parts of the coil. The thermometers may be of the ordinary mercurial type, or they may be electric resistance coils. The second method is to bring out tap-wires from a number of sections of the coil, so as to measure the localized increase in resistance of the coil. The third is to insert thermo-junctions into different parts of the coil. All three methods have been used at different times, and with substantially similar results. The third method is that employed in the tests of the report. The details of the thermo-electric tests are clearly described in a manner worthy of study. In some respects the thermo-electric method has distinct advantages over the resistance method.

The results show that when the field coils of a dynamo are overloaded, so as to reach a mean temperature elevation of, say, 70° C., the maximum temperature in the hottest parts of the coil may be 20° higher, or may reach an elevation of some 90° above the surrounding air. When, however, the mean temperature elevation is, say 30° C., representing more nearly the usual practice in dynamo machinery, the results indicate that the hottest parts of the coils would probably not be more than 5° C. above this. Since the distribution of temperature within an active coil is a most complex subject, far too intricate to permit of precise computation for engineering purposes, there may be special cases in which the interior of a field coil may reach an unduly high temperature under continuous full load. This is more likely to occur with deep coils of fine wire employing plenty of insulating material. Consequently, if the mean temperature elevation of a coil is measured by the resistance method, and also the lowest temperature elevation, on the outside of the coil, by the application of a thermometer, the two readings should agree reasonably well, say within 5° C., in order that the maximum internal temperature may not be far from the mean.

MAGNETIC EFFECT OF ELECTRIC DISPLACEMENT.

When the opposite faces of a dielectric are subjected to a difference of potential, it is found that a certain charge of electricity is required when the wires to the electrodes are first connected to the source of e.m.f., but that after a very small interval of time the demand for electricity practically ceases and the apparatus reaches electric equilibrium. Although the circuit through the dielectric is incomplete, and there can be no current flow in the sense usually implied by that term, there is a transfer of charge into the dielectric,

and the rate of transfer constitutes an actual current from the source of supply. As is well known, the rate of transfer of charge within the dielectric is referred to as a "displacement current," and throughout the circuits leading to the electrodes it possesses the properties common to the currents in the usual transmission circuits. Much discussion has arisen as to the exact nature of the displacement current within the dielectric. This discussion has centered largely upon the question as to the presence of any magnetic effect of the electric displacement, since information concerning this property of the current would serve to settle some of the points in dispute as to the nature of electricity itself.

It has been assumed by Lorentz that the displacement current is made up of two parts, namely, the polarization of the ether and the displacements of the atomic or ionic charges within the molecules of the dielectric. On the basis of this assumption one should expect a magnetic effect from the displacement current. On account of the fact that many experimenters have sought for this effect with negative results, doubt has been cast upon the theory proposed. In 1903 Eichenwald reported upon some experiments which seemed to indicate the existence of the magnetic effect. In a recent issue of the *Physical Review* Prof. J. B. Whitehead describes a series of experiments in which the magnetic effect was directly measured by electrical means. The principles upon which the experiments were based are as follows: If a portion of dielectric be subjected to an alternating e.m.f., alternating displacement currents will be set up in the dielectric. If now the dielectric be surrounded by a magnetic circuit, alternating magnetic induction will be set up therein, and if this circuit be wound with a number of turns of wire, an alternating e.m.f. will be induced therein, and this e.m.f. may set up a current. The value of the current may be both calculated and measured. As constructed the dielectric was a cylinder of paraffin. The e.m.f. was applied to electrodes consisting of circular brass plates on the end faces of the cylinder. Concentric with the cylinder and surrounding it was the laminated magnetic circuit, consisting of soft iron discs. The iron ring thus formed was wound with what may be called the secondary winding, in circuit with which the measuring instrument was connected. The wires leading to the electrodes continued straightaway for one meter on each side, so that the magnetic effect of the current in this portion of the circuit was quite small, but it was determined and properly allowed for in the calculations. Care was taken to eliminate all electrostatic effects from the galvanometer circuit. Although there was a difference of some 50 or 60 per cent between observations and calculations, it is worthy of note that the observed effect was of the same order of magnitude as that calculated, and that the discrepancy was well within the limits of experimental error.

CHAMPIONS OF THE PAST.

Before us lies the first annual report of that well-meaning but somewhat misguided body, the British Weights and Measures Association. It is filled with the usual hysterical appeals to stand by the dear old English inch, and in the name of human liberty to oppose all improvements. It is a curious study in morbid psychology to examine the view-points of the really violent among the contributors. There are opponents of the metric system who are entirely sincere in their objections, but we do not believe that there is among these a corporal's guard really familiar with the working of the system in practice. Most of the contributors chatter volubly about the difficulties of metric measurements without in the least comprehending how they actually work in every-day life. One large class assumes that there is some occult property about metric measures that makes it positively infamous to use anything except even tenths of whatever is measured. In their eyes it is utter subversion of everything metric to make a drawing, for instance, on a scale of 5 cm. to the meter—it must be 1 cm. or 10 cm., else the whole system will fall with a resounding crash. Their attitude reminds one of the amiable old lady in an insane asylum, who often overate because she felt obliged to take three pieces of everything in sight out of respect to the Holy Trinity.

A beautiful example of this position is a quotation from a letter to the *Times,* in which ponderous stress is laid on the fact that the great optical firm of Zeiss makes microscope objectives of 24, 12, etc., millimeters focus to approximate the English inch, ½ inch, etc. The writer also insists that the inch is 25 mm., which of course it is not. Now so far from this manufacture being a source of difficulty to Zeiss, the metric customer would just as soon have 24 mm. in focal length as 25, while the real attitude of the firm is presumably about as follows: "Our excellent but obstinate neighbors rage if they have to buy anything that is not in binary or duodecimal subdivisions like their own barbaric measures; we propose to convert their guineas and such into good German marks, and, since it's really quite the same to us, we will run as near as convenient to their curious system and get their trade." Which they accordingly do in liberal measure. Another group of objectors triumphantly demand how one can quickly and conveniently convert 11 23/32 inches into decimeters, never seeming to realize that no rational human being working with the metric system would ever have the slightest desire or occasion to do so. A very amusing feature of the situation is the appearance of a bold Radical wing of the objectors, which, seeing clearly the abominable complications introduced by the use of vulgar fractions in any but the simplest forms, favors a decimal rearrangement of English units, which would be in most cases more difficult to use than the existing metric system and would simply add to the present difficulties another.

The thing most universal in anti-metric literature is the often repeated tale that the inch is a "natural" measure, that the centimeter is too short and the decimeter too long for "convenience," and much more to the same effect. Now we grant that the inch is a natural measure in the sense that it was once by statute determined as the length of three barley corns. In any other sense it is no more natural or convenient than any other small dimension would be. To a man, particularly an uneducated man, who has been brought up to use the inch, without realizing that anything else was conceivable, the inch seems ideal; but to the man brought up to the metric system the inch seems clumsy and inexact in all its relations as compared with the centimeter. It is this radical difference in point of view that even the most sincere and conscientious advocates of the English system fail to recognize. There is a wide difference between learning parrot-like the metric tables and actually using the system. Too many Englishmen and Americans, we fear, are in the sad case of the school manager who contributes to the report before us a frank confession to the effect that "I am never sure whether to ask for kilogramme of cognac or a hectolitre of bread." Of such there is little to be said. But we wish the people who undertake the discussion of such matters would also take the trouble to familiarize themselves practically with the metric system as an independent working system. Practically all of us who favor its general adoption do know it in just this intimate and practical way, and realize its immense convenience from personal knowledge, not from any preconceived theories as to its fitness. And to those who are thus used to it, as any one may become in a surprisingly short time, the "transition period" has no terrors, as it seems to have for the anti-metric contingent. It will chiefly trouble those who insist on working laboriously in inches and then solemnly converting each dimension into centimeters to the tenth decimal place. For these there is no hope under any regime.

Bethlehem Meeting American Electrochemical Society.

The eighth general meeting of the American Electrochemical Society was opened on Monday afternoon in Lehigh University, South Bethlehem, Pa. Owing to the inclement weather the elaborate arrangements of the Ladies' Committee for Monday afternoon were completely nullified. But at the hotel headquarters and in the chemical laboratory of Lehigh—where the professional sessions are held—the good feeling so characteristic of all the conventions of this society reigned supreme.

Considerably after the time announced for the opening, Dr. Jos. W. Richards, as chairman of the local committee, delivered a brief address of welcome and introduced President Drinker, of Lehigh University, who, in a felicitous little speech, welcomed the society and offered to its members the freedom of Lehigh. President Wilder D. Bancroft replied for the society.

COLLOIDAL SOLUTIONS.

A brief note by Prof. W. S. Franklin and Mr. L. A. Freudenberger was first presented by Mr. Freudenberger to give Prof. Bancroft time to complete the arrangements for his experimental lecture which was first on the programme. The object of the paper was to give some idea of the nature of a colloidal solution by revolving a tube containing the colloid at a high speed. It was expected that on account of the action of the centrifugal force a new condition of equilibrium would be established and that it would be possible to study the variation of the concentration of the solution by optical means, as function of the speed of rotation and of the distance from the axis of rotation. However, these hopes were not fulfilled. No new equilibrium resulted. What happened was that at sufficiently high speed precipitation resulted at the end of the tube, followed by a kind of growth of the precipitation along the tube.

THE CHEMISTRY OF ELECTROCHEMISTRY.

A very interesting experimental lecture by Prof. Wilder D. Bancroft was intended to emphasize a point of view which is singularly strange to electrochemical researches as usually carried out. He made it clear that in a great many cases new points of view are obtained by supplementing electrochemical research by parallel chemical research, and that, for the complete understanding of an electrochemical problem, it is often advantageous to look at it from a purely chemical viewpoint. The action of the electric current is to set the ions free at the electrodes; everything that happens besides and afterwards may be looked upon as a problem of chemistry.

Thus, if we pass a current through a slightly acidified solution of copper sulphate, we get the precipitation of metallic copper. This is merely the normal action of the current setting free the cation, copper, at the cathode. If we acidify the solution still further, adding sulphuric acid in one case and nitric acid in another, we find that a given amount of nitric acid will prevent the precipitation of copper, while much more sulphuric acid must be added to cause the same effect. The reason of this is clear when we consider the chemistry involved. Nitric acid attacks copper readily and sulphuric acid does not. While this is perfectly obvious when stated in this way, it has not been obvious enough in the past to induce anyone to test quantitatively the relation between the decreased current efficiency in a nitric acid solution and the rate of corrosion by that particular solution. We know that the current efficiency increases with current density, which is just what we should expect if the chemical action remains constant; but more than that we do not know.

From the same point of view Dr. Bancroft discussed a great many cathodic as well as anodic reactions, illustrating his discussion by numerous experimental demonstrations. The essence of his paper was that we get a clearer view of the subject as a whole if we consider the chemistry of electrochemistry, and that this point of view is valuable in showing concrete instances of research work which ought to be done. The paper elicited a lively discussion in which Messrs. Hering, Betts, Richards and Burgess participated. Mr. C. J. Reed, in a communicated discussion, disagreed with Prof. Bancroft and brought forward as the fundamental point to be considered in any electrochemical reaction, that only thermochemical or energy considerations can decide which one of different processes—which would be chemically possible—will actually take place. Prof. Burgess thought that Dr. Bancroft's point of view has the great advantage that it enables us to get away from hypotheses and to come right down to the facts.

PHENOMENA OF METAL DEPOSITION.

Mr. Anson G. Betts presented a lengthy paper in which he endeavored to give a general theory of the causes of good or bad metallic deposits. He considered in detail the effect, obtained by the addition of colloids, by reducing agents, strength of acid and alkalinity of base. He then discussed the small local concentration cells which are set up at the surface of a rough electrode, due to differences of concentration of the electrolyte on the ridges and in the hollows of an electrodeposit. He then spoke on crystalline structure of deposits and on hardness.

The chief point brought out was that a hard metal will separate in solid compact form, and a soft metal will deposit in a loose crystalline form. When the hardness is intermediate the valency of the metal will become a determining factor, high valencies producing solid deposits and low valencies loose deposits. If a metal is not hard of itself it will help the solidity if by some means we can deposit it in hard form. Silver deposited from a cyanide solution with the addition of carbon bisulphide, is harder than ordinary silver, and is bright. The author finally discussed the relation between surface tension and hardness. Many detailed applications of his rules were given.

The paper was discussed by Messrs. Burgess, Franklin, Bancroft and Richards. Some of the speakers believed that the broad generalizations of Mr. Betts were not sufficiently proven.

On the evening of Monday the members of the society attended a reception given at the home of Prof. and Mrs. J. W. Richards by the Ladies' Committee and afterwards an enjoyable smoker was held at the club house of the Lincoln Republican Club.

ALUMINUM AS REDUCING AGENT.

The first paper of the Tuesday session by Dr. O. P. Watts contained notes on the use of aluminum as a reducing agent. In the absence of the author it was presented by Prof. C. F. Burgess. Goldschmidt's aluminothermic method is unable to yield the pure metals titanium, tungsten, uranium, since the energy required for the reduction of the oxides has too high a value; i. e., the heat evolved by the oxidation of the aluminum is alone not sufficient. Watts added to it, therefore, the heat of the electric arc. Powdered fluorspar or cryolite was added to the charge to reduce the velocity of reaction. The charge was placed in the cavity of a furnace with a magnesite lining, the cover put on and an arc started just above the charge. The usual heating was for 5 minutes at 300 amp. and 70 volts, followed by 5 minutes more at 600 amp. and 80 volts. The author states that this combination of the Goldschmidt method with electric arc heating is thoroughly safe.

ELECTRIC STEEL FURNACE.

A paper by Gustave Gin on his new process for the electric manufacture of steel was presented in abstract by Dr. J. W. Richards. The furnace contains essentially three compartments: First, a crucible for fusion and refining by oxidation; second, a compartment for reduction and recarburization; third, a chamber for the color test. The current is introduced through the electrodes provided in the first compartment, while the electrodes of the second and of the third compartments are in parallel with each other and are connected with the other terminal of the supply circuit. The electrodes dip into the slag at the top of the bath, but not into the bath itself.

The paper elicited a lengthy and animated discussion in which the practicability of the Gin process was questioned for various reasons. Dr. Leonard Waldo presented what was essentially a new paper—an interesting resume of the development of the induction furnace and of various peculiar observations which he has made with it in practice.

REFINING SILVER.

A paper on this subject was presented by Mr. A. G. Betts briefly, in abstract. It referred essentially to the use of salts of strong acids forming soluble silver salts. The best acid is methyl-sulphuric acid, and a small addition of carbon bisulphide improves the deposit.

INSULATING PAINTS.

An interesting paper on this subject was presented by Dr. Maximilian Toch, which will receive further notice in our next issue, since it is intimately connected with problems brought up by experiences made on the subway and elevated roads in New York. One very peculiar observation made by Dr. Toch was that (while both terminals showed corrosion), yet the minus side (cathode) corroded much more. This particular point was discussed to some extent.

PARTING OF BULLION.

A suggestive paper on electrolytic versus sulphuric acid parting

of bullion was presented by Mr. F. D. Easterbrooks, of the Raritan Copper Works, of Perth Amboy, N. J. The author first pointed out the main disadvantages of the sulphuric acid process, which are general uncleanliness and a special difficulty with respect to tellurium. Both disadvantages do not exist in electrolytic parting. The author discussed three printing processes—those of Moebius, of Balbach and what may be called the gelatine adherent deposit method. The latter method has the advantage of greater ease of handling.

ACTIVE OXYGEN.

An instructive paper on the utilization of active oxygen, chemically and electrically produced, was presented by Dr. R. von Foregger, of the Roessler & Hasslacher Company. The paper referred to the manufacture of a new commercial series of peroxides with a high energy contact. They can be used for the production of active oxygen whenever and wherever needed, and are therefore specially adapted for bleaching, sterilizing and analogous processes. Perhaps the most interesting of these compounds, called "oxone," is fused sodium peroxide, which when dissolved in water, develops oxygen, just as calcium carbide, when dissolved in water, yields acetylene.

The paper elicited a long discussion in which Messrs. Toch, Franklin, Doremus, Sadtler, Carrier and Richards participated. One interesting point brought out was that the use of "oxone" not only enables one to produce oxygen but that simultaneously carbon dioxide is consumed. This is, for instance, important for sanitary purposes. The peroxides discussed in the paper are the outcome of the electrolytic production of sodium at Niagara Falls.

ELECTROCHEMICAL INDEX.

Mr. C. F. Carrier, Jr., gave a brief and interesting account of the thorough work being done by Mr. A. Voege and the Concilium Bibliographicum in Zurich in the preparation of a complete card index of articles published on electrochemical subjects in all periodicals of the world.

PICKLING SOLUTIONS.

Prof. C. F. Burgess presented some interesting observations on the influence of arsenic in pickling solutions. It was found that arsenic exerts a marked influence in diminishing the rotting effect of a sulphuric acid solution. In a solution of hydrochloric acid having a corresponding strength, the presence of arsenic exerts a similar but less pronounced influence. A steel spring pickled in an arsenic containing pickle and subsequently nickel-plated, was found to be stronger than when pickled in pure acid before plating. The author suggested that the effects of arsenic should be further investigated.

ELECTRIC ZINC SMELTING.

A paper by O. W. Brown and W. F. Oesterle on the electric smelting of zinc was read, in the absence of the authors, by Mr. S. S. Sadtler. The authors discussed the very low efficiency of the ordinary zinc smelting process and gave an extended resume of attempts that have been made to use electricity in such processes. They have worked themselves in the direction of reducing zinc from ores in the electric furnace without preliminary roasting by using a suitable mixture of ore, lime and carbon.

Some notes on the electrometallurgy of antimony were then presented, by title, by Mr. A. G. Betts.

After the conclusion of the Tuesday morning session, lunch was tendered to the members of the society at the Gymnasium by the authorities of Lehigh University. Various buildings, especially that of the Departments of Electrical Engineering and of Physics, were then visited. Then followed two extended and most enjoyable visits to the large zinc works in South Bethlehem and to the magnificent plant of the Bethlehem Steel Company. A subscription dinner was held in the evening in the Eagle Hotel.

The Street Railway Week in Philadelphia.

The twenty-fourth annual meeting of the American Street Railway Association will be held in Philadelphia next week at the Bellevue-Stratford and at the Philadelphia Museum, the exhibit of apparatus, etc., taking place at the museum. Details have already appeared in these pages as to the features of the week, and also as to the proposed reorganization and enlargement of the association; and it is evident that in many ways the week will mark an epoch in the history of the street railway industry. We now give below the programmes as at present constituted, of the parent and allied bodies:

American Street Railway Association.—Wednesday, September 27, 10 a. m.—Address of welcome. Address of the president, Mr. W. Caryl Ely; approval of minutes of last annual meeting; report of the Executive Committee; report of the secretary-treasurer; report of standing committees; report of the Re-organization Committee; consideration of, and action on, new Constitution and By-Laws; appointment of Nominating committee. Paper on "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," Mr. Arthur West, Westinghouse Electric & Manufacturing Company. Paper on "The Application of Gas Power to Electric Railway Work," Mr. J. R. Bibbins, Westinghouse Electric & Manufacturing Company. Paper on "Single-Phase Railway System," Mr. Chas. F. Scott, Westinghouse Electric & Manufacturing Company. 8 p. m.—Theatre party at New Lyric Theatre, John C. Fisher's production of "Babes in the Wood."

Thursday, September 28.—10 a. m.—Unfinished business; new business; report of Nominating Committee; election of officers for ensuing year. 8 p. m.—Banquet at the Bellevue-Stratford Hotel.

Street Railway Accountants' Association of America.—Thursday, September 28.—2 p. m.—Annual address of President W. G. Ross, Montreal, Canada; annual report of the Executive Committee; annual report of the secretary-treasurer; appointment of Convention Committee on Nominations; appointment of Convention Committee on Resolutions; report on proposed reorganization of the American Street Railway Association.

Friday, September 29.—10 a. m.—Annual report of Standing Committee on Standard Classification of Accounts. C. N. Duffy, secretary and auditor, Chicago City Railway Company, chairman. Report of Committee on International Form of Report. C. N. Duffy, secretary and auditor, Chicago City Railway Company, chairman. Report of committee to attend convention of National Association of Railway Commissioners, held at Birmingham, Ala., November 15, 16 and 17, 1904. C. N. Duffy, secretary and auditor, Chicago City Railway Company, chairman. Annual report of Standing Committee on Standard Form of Report. W. F. Ham, comptroller, Washington Railway & Electric Company, chairman. Report of committee to attend convention of National Association of Railway Commissioners, held at Deadwood, S. D., August 15, 16 and 17, 1905. W. F. Ham, comptroller, Washington Railway & Electric Company, chairman. Reading and discussion of questions and answers in the Question Box. This includes those published and any others that may be presented. 2 p. m.—Paper on "The Cost of Carrying a Passenger." C. L. S. Tingley, second vice-president American Railways Company, Philadelphia, Pa. Paper on "Interurban Fare Collections." Irwin Fullerton, auditor Detroit United Railway, Detroit, Mich. Paper on "Interurban Ticket Accounting." J. H. Pardee, general manager Rochester & Eastern Rapid Railway, Canandaigua, N. Y. Paper on "Accounting with Four Departments." H. M. Beardsley, secretary and treasurer Elmira Water, Light & Railway Company, Elmira, N. Y. 2.30 p. m.—Grand ladies' trolley party by courtesy of President J. H. Porter, Fairmont Park Transportation. 8.30 to 12 p. m.—Vaudeville entertainment, by street railway talent, ballroom, Bellevue-Stratford Hotel. Dancing.

Saturday, September 30.—10 a. m.—Unfinished business; report of Convention Committee on Resolutions; report of Convention Committee on Nominations; election and installation of officers.

American Railway, Mechanical and Electrical Association.—Monday, September 25.—10 a. m.—Address of welcome, Hon. John Weaver, Mayor of Philadelphia; address by Hon. W. Caryl Ely, president American Street Railway Association; president's annual address; report of the Executive Committee; report of the secretary and treasurer. 1.30 p. m. sharp.—Paper, "Power Distribution," by C. H. Hile, superintendent of wires, Boston Elevated Railway Company, Boston, Mass. Paper, "The Power Station Load Factor as a Factor in the Cost of Operation," by L. P. Crecelius, chief electrician of the United Railways Company, St. Louis, Mo. Report of the Committee on "Controlling Apparatus," Chairman J. S. Doyle, master mechanic Interborough Rapid Transit Company, New York, N. Y.

Tuesday, September 26, 9 a. m. sharp.—Report of the Committee on Way Matters—"Welding of Rail Joints"; chairman, F. G. Simmons, superintendent of construction and maintenance of way, the Milwaukee Electric Railway & Light Company, Milwaukee, Wis. Report of the Committee on "Maintenance and Inspection of Elec-

trical Equipment"; chairman, William Pestell, New York, N. Y. Paper, "The Power House," by Fred N. Bushnell, chief engineer the Rhode Island Company, Providence, R. I. 1.30 p. m. sharp.—Paper, "The Track Brake," by F. F. Bodler, master mechanic the United Railroads of San Francisco, San Francisco, Cal. Discussion of the Question Box. Reports of special committees. Election of officers. 9 to 12 p. m.—Reception given by local Reception Committee, Mr. James F. Rawle, chairman, in ball room, Bellevue-Stratford Hotel. Dancing.

American Association of Street Railway Claim Agents, Tuesday, September 26—Meeting at 1048 Land Title & Trust Company Building, Broad and Chestnut Streets, 10 a.m.—Reading of minutes of last meeting. Report of membership. Report of treasurer. Discussions of accident claims and methods of fakirs. Election of officers.

The entertainments noted under the various dates are, of course, common to the various bodies participating in the convention, and in general, aside from specific courtesies and functions, are under the supervision of the Manufacturers' Association of the American Street Railway Association, which also has charge of the fine exhibit of apparatus at the Philadelphia Museum. Strong local reception and entertainment committees have been formed, with Mr. John B. Parsons at their head.

Delegates will obtain badges for themselves and their guests and ladies accompanying them from Mr. T. C. Penington, secretary American Street Railway Association. Members of the Manufacturers' committee and their representatives will obtain badges for themselves, their guests and ladies accompanying them from Mr. Edwin H. Baker, chairman Finance Committee, at Appliance Exhibition, South Pavilion, Philadelphia Museum, West Philadelphia. The official badges of the convention are numbered by means of celluloid tags for the purpose of protection against abuse by persons not entitled to wear them. Delegates and guests are especially requested and urged not to remove the numbers, but to wear them in plain sight.

Free transportation on the street railways of Philadelphia will be given those holding tickets, which will be given when taking out membership, by applying to Mr. T. C. Penington or Mr. E. H. Baker. Only those provided with proper badges, etc., will be admitted to the various entertainments.

The headquarters will be at the Bellevue-Stratford Hotel. Rates are as follows: European plan—Single rooms, without bath, $2.50 per day and up; single rooms, with bath, $3 per day and up; if two persons occupy a single room the rate will be $1 more; double rooms, without bath, two persons, $3.50 per day and up; double rooms, with bath, two persons, $4.50 per day and up.

The Patent Office Year.

The annual report of the Commissioner of Patents shows that the twelve months ended June 30 last was the banner year in the history of the United States Patent Office. The receipts of the office were more than a million and a half dollars and the expenditures were a quarter of a million less. The report says:

"There were received in the last fiscal year 52,323 applications for mechanical patents, 749 applications for designs, 174 applications for reissues, 1,846 caveats, 11,298 applications for trade marks, 1,236 applications for labels and 448 applications for prints. There were 30,266 patents granted, including reissues and designs, and 1,426 trade marks, 1,028 labels and 345 prints were registered. The number of patents that expired was 19,567. The number of allowed applications which were by operation of law forfeited for non-payment of the final fees was 5,154.

"The total receipts of the office were $1,737,334; the total expenditures, $1,472,467, and the surplus of receipts over expenditures, being the amount turned into the treasury, was $264,667.

"The most important event which has occurred in the operation of the Patent Office during the last year has been taking effect of the new trade mark law, which took effect April 1. This new law, in extending the registration of trade marks to those employed in interstate commerce and in its reduction of the Government fee of $25 to $10, has stimulated an enormous increase in the trade mark work of the office. The statute also provides for oppositions to the registration of trade marks, which is a new subject of litigation in the business of this office."

Telegraphs and Pool Rooms.

The directors of the Western Union Telegraph Company have adopted the following resolutions of Mr. Jacob Schiff:

"Whereas, this company, under an order issued by its president on the 18th day of May, 1904, has directed the cessation of the collection of horse race reports, and

"Whereas, it is claimed that the distribution of horse race reports still continues, notwithstanding the action of this company first referred to, be it

"*Resolved,* That it is recommended to the board of directors that the offices of the Western Union Telegraph Company be directed to cease the transmission of any messages containing horse race reports, except where such messages are delivered to a regular office of the company for transmission to and delivery through a regular office of the company or for delivery in such other manner as the president of the company shall authorize over his signature."

Mr. Schiff had to fight hard to retain in the resolution, when introduced originally some few months ago, the clause stating that "the distribution of horse race reports still continues, notwithstanding the action of this company." Some of the members of the committee thought this sounded too much like a confession. Mr. Schiff retorted that confession was good for the soul and insisted on the truth, the whole truth and nothing but the truth.

Direct Cable to Japan.

The Commercial Pacific Cable Company, through its president, Clarence H. Mackay, announces that it has secured the necessary concessions to enter Yokohama, Japan, and Shanghai, China. M. Takahira, the Japanese Minister to the United States, on September 14 affixed his signature to Japan's agreement with the Commercial Pacific Cable Company for landing rights at Yokohama. An agreement for landing rights at Shanghai was signed by China several weeks ago. The cable connections with both Japan and China will be made by extending the present lines of the company, which run from San Francisco through the stations at Honolulu and Guam to Manila. Japan will be reached by laying a cable from Guam in the Pacific Ocean direct to Yokohama. The cable to China will be laid from Manila to Shanghai. Mr. Mackay says the company will proceed at once with the manufacture and laying of these two cables, which will take several months. The Commercial Pacific Cable Company will then pierce the Far East at three points, namely, the Philippines, China and Japan. With the cable which has just been completed to Newfoundland, plus a fifth cable to Europe, which will be laid this month, and the cable from Guam to Japan, and one from Manila to Shanghai, the company will have a system extending over two-thirds of the way around the globe.

A Trolley for Yellowstone Park.

The following letter from Mr. John T. Nagle to the *New York Sun* suggests a means of dealing with the difficulties of transportation in the Yellowstone Park:

I have read with interest an editorial in your issue of Sept. 3 entitled "A Menace to the Yellowstone," and I fully agree with you that a steam railroad should not be constructed through the national park; but the discomforts to which the tourist is subjected in traveling by the stages now in use are such that I believe a trolley road should be constructed and operated by the Government.

The trolley is desirable, I think, for the following principal reasons:

First, because it is the cheapest, cleanest and most comfortable way of traveling. Second, because you can see more in a given time and reach more difficult places of access than you can by stage or coach. Third, because baggage, provisions and other necessities can be carried more conveniently and mail matter delivered more promptly than by horses. Fourth, because more visitors could be carried by trolley than by coaches.

I believe the tourist to this grand national park would appreciate a trolley through it as much as the visitors to Niagara Falls now

appreciate the trolley that has replaced the old time hacks. I do not entirely agree with Capt. Chittenden that "a trolley would work serious damage to the game and forests, to say nothing of their effect on the natural beauty of the regions, and that the people prefer to travel by hired horses, even if the discomforts are greater." I cannot see how a trolley line of about 200 or 300 miles would "mar the beauty or work serious damage to the game or forests" of a park which contains 3,312 square miles and a large forest reserve in addition. The cost of a trip by trolley operated by the Government could not possibly exceed three cents a mile, or $4.50 for the distance of 150 miles—the distance traveled by the Yellowstone coaches, while the fare for this distance now charged by them is $27. With the cheaper railroad fares to reach the park and certain improvements in it that would add to the comfort of the visitors, and with proper facilities and low rates to reach the various points of interest in the park, I believe that in a few years the great tourist travel will be directed to this scenic wonder instead of to Europe.

A Tour of Independent Telephone Leaders.

A large party of independent telephone leaders have been making a tour of the country, preliminary, it is said, to the consolidation of long-distance lines in a company with a capital of $12,500,000. In the party are: From St. Louis—Breckenridge Jones, vice-president and counsel Mississippi Valley Trust Company, director Union Electric Light & Power Company and Laclede Gas Company, treasurer Kinloch Telephone Company; C. Marquard Forster, president Kinloch Long-Distance Telephone Company and vice-president St. Louis Brewing Association; William F. Nolker, president Kinloch Telephone Company; H. L. Reber, general manager Kinloch Telephone Company; W. Roy McCanne, assistant general manager Kinloch Long-Distance Telephone Company; W. G. Lackey, bond officer Mississippi Valley Trust Company; Herman C. Stifel, with Altheimer & Rulings Investment Company; Adolphus Busch, president Anheuser-Busch Brewing Company.

From Kansas City—Joseph J. Heim, president Kansas City Home Telephone Company, president Heim Brewing Company; O. C. Snider, general manager Kansas City Home Telephone Company.

From Indianapolis—H. B. Sale, general manager New Long-Distance Telephone Company and Indianapolis Telephone Company; Newton Todd, broker.

From Cleveland—J. B. Hoge, secretary Cuyahoga Telephone Company, president National Interstate Telephone Association.

From Pittsburg—J. G. Splane, president P. & A. Telephone Company; Robert C. Hall, director P. & A. Telephone Company; H. B. Beatty, president Manufacturers' Light, Heat & Power Company; Frank Hart, superintendent Long-Distance P. & A. Telephone Company; N. C. McPherson, general manager Duquesne Light Company; William Flinn, S. S. Lesslie, Jr., D. P. Heighard, director P. & A. Telephone Company; John S. Weller, vice-president and general counsel P. & A. Telephone Company; R. H. Binns, director P. & A. Telephone Company; Ralph E. Flinn, director P. & A. Telephone Company, and H. M. Nichols, president Citizens' Bank, of Oil City.

One of the cities visited was Pittsburg and another was Rochester, N. Y., where the Stromberg-Carlson manufacturing plant was inspected, and where a dinner was given at the Genesee Valley Club. President Hoge, of Cleveland, said in the course of his remarks: "The possibilities in the way of consolidation were never so great as now. We have been talking for years of having two great competing telephone companies, the same as we have two great competing telegraph companies. Our system covers practically the same territory as that of our opponents, and with the stringing of but little additional lines we will be in good shape to take up the fight. We are and have been constantly getting ready for consolidation. We have tried to standardize our rules and regulations and also our methods of accounting so as to make possible at the earliest possible date the forming of this projected national association with each State divided up into districts, with each district holding meetings to elect delegates to the State convention at which delegates to the national convention would be selected. I believe the day is near at hand when all this will be realized."

Among the cities to be visited are Cleveland, Indianapolis, Kansas City and St. Louis. The consolidation proposed is likely to occur, it is said, during the fall of the year.

The French Cable and Venezuela.

Advices from Paris state that a settlement is in sight in regard to the dispute between the French Cable Company and the government of Venezuela. Mr. Foquet, in Paris, is reported as saying on behalf of the cable interests: "When the courts of Venezuela pronounced the canceling of the contract between the French company and Venezuela President Castro issued a decree in execution of that judgment. This decree set forth that on September 16 all the offices of the French Cable Company should be closed for interurban Venezuelan communications, only the office at La Guayra remaining open for communication with Europe. A government representative was to be stationed in the La Guayra office, who would control every message received or sent and would deduct one boliver per word on all messages received or sent as a tax for the government. We were informed on Friday that President Castro had decided to postpone the execution of this decree in order to permit of negotiations, and that a note to this effect would be published in the Venezuelan Official Gazette. Up to the present we have not received official confirmation that the decree has been prorogued, but believe it has been. This shows that Castro is disposed to negotiate; consequently negotiations will proceed."

"President Castro does not wish the French cable to be used for Venezuelan interurban or coast work. He wishes the government land lines used on principle. We are disposed to meet him on this point. So long as we have our land terminus at La Guayra for communication with abroad, that is, after all, the main thing. But we pointed out to President Castro that we have spent millions in laying coast lines. The point now to settle is what compensation President Castro will give us for our property. There is no need for him to resort to brutal methods in the matter."

New Stages for Fifth Ave., New York.

The Fifth Avenue Coach Company has placed on trial for Fifth Avenue service a gasoline-electric motor omnibus, which will run on regular schedule between Washington Square and Eighty-eighth Street. It is now being run for experimental purposes in the evening. In designing this 'bus the object was to produce a vehicle that could be operated with safety and speed through the heavy traffic of the avenue. The vehicle has cross seats, with a center aisle, so that passengers face forward and have a good view. The company declares that five-cent fares would not yield a profit, but in return for the ten-cent fare it is proposed to give every passenger a seat and allow no one to stand in the aisles.

The motive power of the omnibus is from the design of the General Electric Company and the omnibus was built by the Vehicle Equipment Company and consists of a 40-horse gasoline generator outfit and two motors. It is brilliantly lighted from a small storage battery, which also supplies current to start the engine, thereby avoiding the "cranking" operation customary on gasoline cars.

The 'bus makes the round trip from Eighty-eighth Street to Washington Square in about an hour, as against an hour and forty-five minutes with the old horse omnibus.

Deterioration of Copper Wire.

In the discussion on Mr. Fowle's paper on railway telephone service at the recent convention of the Association of Railway Telegraph Superintendents, some interesting facts were brought out as to the life of copper wires. Mr. Kinsman, of the Wabash Railroad, stated that copper wires along that road had been used for 15 or 18 years without showing any signs of deterioration. Mr. Griffith stated that copper wire at a certain point on the Erie Railroad, in proximity to a chemical works, lasted about three and a half years, while Mr. Hewitt referred to a case in Texas where twenty miles of copper wire in the Beaumont oil region had been badly impaired in two years by the sulphurous atmosphere. The iron wire in the same region is eaten up in about one year. In Beaumont lead-covered cable is used with good results, the lead apparently acting as a protection against the sulphur fumes. Mr. Griffith referred to a test of aluminum wire on the Erie road at the point above mentioned. It worked well for about six months when, one day, the circuit was broken. Investigation showed that three sections of the wire had "evaporated."

San Joaquin Power Development.

The San Joaquin Power Co., Fresno, Cal., is now in the midst of the development of a large amount of power to be used in the various Huntington enterprises, and for pumping water for irrigating purposes. The estimated cost of the work now under way is $850,000, and as soon as this is completed, other operations will be taken up. Teams start from Pollasky with freight consisting of cement, steel for the flumes and pipe lines, machinery, etc., much of which is going to a point between North Fork and Crane Valley. The new ditch to be built from the Crane Valley dam to the Morton & Banta mill site, where Power Plant No. 3 is in course of construction, will be cemented. The power house will be completed within a month, probably, but the electrical equipment is not expected until the latter part of October. The water for power will be drawn directly from the lower Crane Valley dam and brought by the ditch and flume to the top of the mountain above Morton & Banta's mill, giving a fall of 401 ft. The pipe line coming down this mountain will be 3,020 ft. long, 52 in. inside diameter. At the head of the latter a reservoir is being built sufficient to hold 12 hours' run supply.

A reservoir is to be constructed in Crane Valley, which will enable the company to store 40,000 acre-feet of water with a 100-ft. dam. It is the intention to rebuild the present ditch and flume from Crane Valley to power plant No. 1, and the two power plants are to be connected with an 8½-pole line, which has already been built. A double-pole line is now being built from power house No. 1 to Fresno, a distance of 39 miles, which will make it possible to step-up the pressure to 33,000 volts instead of 19,000, as at present. At Copper Mine a switching station is being built, through which both pole lines will pass. The contract for the power house equipment calls for Bullock generators driven by Doble water wheels.

Telephone Density.

The question of telephone density as an indication of the limits of the future growth of the telephone business in this country is one which has received considerable attention of late. It has been a matter of common knowledge among telephone interests, says the *Wall Street Journal,* that the density in the Pacific States was abnormally high, and reasoning on this basis the generalization has been easily made that the density of the West was much higher than in the East. A few weeks ago the Pacific States Telephone & Telegraph Company, a sub-company of the Bell system, published figures showing the ratio of telephones per 100 of population in its territory as of July 31, 1905. This company includes in its territory the three States of California, Washington and Oregon, which in the order named lead the country in point of density and for that matter excel any other communities in the world. California, which heads the list, has 133,000 telephone subscribers in a population of 1,300,000—better than 10 per cent.

The six New England States also constitute a section of the country in which the development of the Bell telephone system is very large in proportion to the population. The following table shows the name of the exchange, the number of subscribers and the ratio per 100 of population in several Massachusetts cities and towns and the average for the entire State as of January 1, 1905:

Exchange.	Subscribers.	Ratio per 100 people.
Boston	38,205	6.4
Worcester	6,375	4.9
Springfield	5,046	6.8
Lowell	3,199	3.3
Brookline	3,122	13.5
Cambridge	3,000	3.0
Newton	2,932	7.9
Lynn	2,625	3.4
Haverhill	2,221	6.0
Holyoke	1,626	3.2
Salem	1,312	3.5
Pittsfield	1,191	4.7
Malden	1,152	3.0
State	114,856	3.8

The entire New England field covered by the American Bell companies had a total on January 1 of 208,814 subscribers, or a density of 3.48 per cent. The following table shows the number of subscribers and the telephone density in several countries of the world as of January 1, 1905:

Country.	Subscribers.	Ratio per 100 people.
Germany	445,000	.89
Great Britain	367,000	.86
France	122,900	.31
Sweden	110,100	2.11
Switzerland	52,500	1.59

The above figures show that the nearest competitor to New England in point of density is Sweden, with a ratio of 2.11 per cent. The comparison in favor of New England is likely to be still further accentuated when it is stated that the ratio of increase in the six New England States during the present year is at the rate of over 40,000 subscribers per year—a gain of 20 per cent.

CURRENT NEWS AND NOTES.

CANADIAN STREET RAILWAY ASSOCIATION.—At the last meeting of the Canadian Street Railway Association, held at St. John, N. B., August 30, it was decided that the convention should be held semi-annually in the future. The next meeting will be held in London, Ont. Among the papers considered at the meeting was one on "Street Railway Accounts," J. M. Smith.

A MUNICIPAL PLANT.—It is stated that Mr. Frank G. Ray, of the Ohio State bureau of uniform accounting, has found a bad condition of affairs in the village of Huron in connection with the municipal lighting plant. After five days' work he was unable to make anything out of the accounts, except that there was an overdraft of $3,000. The plant has lost money for the village in the six years of its operation and is now in bad shape. Mr. Ray would give no details of his findings to the Huron council, but his report to the auditor of the State is expected to be a hot one.

EDISON CONVENTION.—An account was given in these pages last week of the convention of the Association of Edison Illuminating Companies at Bluff Point. The meeting closed, at Bluff Point, Lake Champlain, after our forms had gone to press. Mr. Joseph B. McCall, of Philadelphia, the president, received the honor of re-election and will thus serve a third term. The distinction is, we believe, unique, or at least very rare in the affairs of the association, and shows how highly the energetic and successful administration of affairs is appreciated by Mr. McCall's fellow members.

NEW YORK TELEPHONY.—It is stated from Cleveland that the Federal Telephone Company, which controls the most extensive independent system in the United States, is endeavoring to secure a franchise for an independent company in New York City, with the view of competing with the monopoly. Frederick S. Dickson, president of the Federal Company, states that the lines controlled by the company will soon be in operation from Pittsburg to Philadelphia and Baltimore, as well as from Cleveland to Albany by way of Buffalo, and to Rochester and Syracuse.

TELEPHONE RATES REDUCED.—Reduction in telephone rates in The Bronx, New York city, have been announced to take effect October 1. The rate for a business service of 600 messages has been reduced from $54 to $48. For a residence service of 500 messages the rate will be $39 instead of $48, the former rate. Excess local messages will be charged for at five cents each, the old rate being seven cents. A material reduction has been made in the charge for a private branch exchange service. The existing rate is the same as that charged in Manhattan. The new rate will be $150 for a switchboard, two lines to the central office, two telephones and 2,400 messages a year.

FULTON CENTENNIAL.—The Committee on Plan and Scope of the Fulton Centennial Commission, appointed by Mayor McClellan, met this week at the rooms of the Board of Trade and Transportation and discussed the idea of commemorating the establishment of steam navigation on the Hudson River. The committee agreed to report the idea of building a water gate, establishing a marine museum, which would be a permanent affair, and to have a grand naval parade and a three days' celebration. It was also decided to recommend the holding of a marine congress in New York and invite people from all parts of the world to attend it. This would be followed by a conference looking toward the development of the American merchant marine. The plan is to hold the celebration beginning August 1, 1907.

POWER OF THE ASSINIBOINE.—A syndicate composed of Canadian and American capitalists proposes to develop the water power on the Assiniboine at Brandon, Manitoba, and to erect a large power house and plant at Curries Landing.

CONDUITS FOR OAKLAND, CAL.—The City Council of Oakland, Cal., has passed an ordinance providing that all the wires of the city shall be placed under ground within the fire limits. This includes all wires except those of the Oakland Traction Company. The measure was passed unanimously. It will require three years to complete the work of laying the wire under ground.

AUSTRIAN STATE TRACTION.—It is stated that the first steps have been taken by the managers of the Austrian State railways to electrify a large section of the system on the Upper Austrian, Salzburg, Tyrolese and other Alpine lines, as also on the Tauern Railway, now in course of construction. For this purpose water power in the Alpine regions has been secured, as also on the River Salza, near Golling, in the Salzburg area.

MUNICIPAL OWNERSHIP.—The first move of the general commission on municipal ownership and co-operation of public utilities appointed by the National Civic Federation will be made at a meeting called for October 5 at Columbia University, New York City. It is proposed then to appoint a sub-committee of nine to be sent to Europe for four months to investigate the results of municipal ownership abroad. A similar committee will make inquiries in this country.

STARTER FOR MERCURY VAPOR LAMP.—A solution of the problem of rendering the vapor of mercury conducting is disclosed in a patent issued September 12 to C. J. Coleman. The inventor provides means for projecting a complete stream of mercury upward through the tube, so that a closed circuit will be established through the lamp. Within the lower portion of the tube is placed a piston of iron having within it a chamber open at its lower end and closed at its upper end, except at a jet-orifice through which the mercury is forced when the piston is moved rapidly downward. The piston is drawn downward by a powerful electromagnet, the circuit to which is completed when the main lamp switch is closed and is opened when the current passes through the stream of mercury.

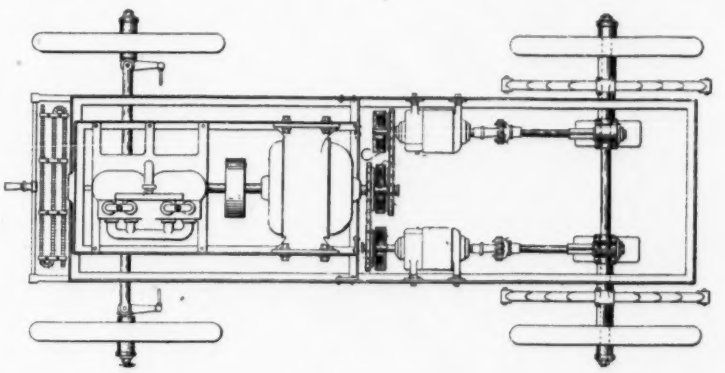
WATER IN THE LAKES.—The International Waterways Commission held a session at Toronto, Ont. Acting Mayor Spence told the commission of the injurious effect of low water at Toronto. Should it go much lower the harbor would be unnavigable, he said. Harbor Master Postlethwaite spoke against the construction of a dam across the Niagara River at or near Buffalo. It would be impossible to raise Lake Erie without reducing the level of Lake Ontario, he said. Several members of the Board of Trade addressed the commission, opposing any measures that would reduce the present level of Lake Ontario. In regard to this inquiry we may note the fact that whatever else the power plants on Niagara may do, they do not lower the level of the lakes. Probably they help maintain it.

ELEVATOR AT LUCERNE.—It is said that the highest elevator in the world has been installed opposite Lucerne, Switzerland, at the celebrated viewpoint of Burgenstock. To reach this elevator the traveler takes the cog-road from Kehrsiten on the shore of the lake to the hotels of Kehrsiten. Thence a most picturesque road cut out of the rocky side of the mountains overhanging the lake takes the traveler in thirty minutes to the elevator, the shaft of which is hidden in a grotto excavated alongside the engine house. The elevator is run by electricity. The carriage or cage is twelve feet square and its passengers are limited to seven. When the signal to start is given the cage rises for 213 ft. through a well of masonry, then comes suddenly into the daylight, and for 387 ft. rises in a steel lattice work to the landing stage, the total ascension of 600 ft. being made in less than three minutes. From the landing stage an open gallery leads to the summit of the Hammet-Schwand Mountain 3,600 ft. above the sea level. From this point a glorious view is had of the lake of the Four Cantons and of the Alps of Uri and Unterwald. The elevator cage is lifted by two steel cables and contains an arrangement by which, in the event of the electric power being interrupted, it can be lowered by hand to the starting point.

LONG-DISTANCE TELEPHONY.—A special dispatch from Pittsburg says: "A member of the Independent Long-Distance Telephone Association which has been meeting here says that while in time all the independent telephone companies may be consolidated by mutual agreement, no such consolidation is probable for several years at least. At the present time the association is endeavoring to perfect arrangements for consolidation of the long-distance lines only. It was not possible to complete arrangements here and another conference will be held next week at St. Louis. The following companies are interested in the movement: The Allegheny Telephone Company, the Independent Long-Distance Telephone & Telegraph Company, of Louisville, Ky.; the New Long-Distance Telephone Company, of Indianapolis, Ind.; the Kinloch Long-Distance Telephone Company, of St. Louis; the United States Telephone Company, of Cleveland, Ohio; the Independent Telephone Company, of Kansas City, Mo."

LAKE MICHIGAN TELEPHONE CABLE.—Preparations for laying the United States Government telephone cable from Charlevoix, Mich., to St. James, Beaver Island, in the middle of Lake Michigan, having been completed, the Federal cable boat started with the actual work on September 12. An hour later the cable boat was four miles out and reported favorable progress. Telephone communication was established with the vessel, so that messages might be sent constantly to Charlevoix, while the cable was being laid. Congress appropriated $35,000 last winter for this line in order that connection might be had with Beaver Island, where the Weather Bureau proposes to establish a storm-warning station. The cable will also furnish means of communication for the large fishing industry, and for residents of Beaver Island, and will be especially valuable to vessels and yachts that seek Beaver Harbor for refuge during storms. The work of laying the cable was done under the supervision of J. H. Robinson, superintendent of telegraphs of the United States Weather Bureau.

COMBINED ENGINE AND MOTOR AUTOMOBILE.—In order to obtain the flexibility of the electric drive for an automobile at low speeds and to eliminate the electric losses at high speed, H. Lemp, according to a patent issued September 12, would equip the machine with a gasoline engine direct-connected to an electric generator, and would provide two electric motors geared to the rear wheels for the purpose of propelling the vehicle at low speeds. The shafts of the motors are connected to the shaft of the gas engine through sprocket chains and magnetic clutches. The controller is arranged for one backward and three forward running positions. At the lowest forward speed the two motors are connected in series. At the inter-



mediate speed the motors are connected in parallel. When the controller is moved to the high-speed position, the motor circuits are open and the generator circuit is closed through the coils of the electromagnetic clutches, so that the shaft of the gas engine is mechanically connected through the clutches to the rear wheels. In the single backward-running position the two motors are connected in series. No differential gears are used because at low speeds the motors produce the proper differential action, and at high speeds it is advantageous to do away with differential gears in order to diminish the liability of skidding. This patent has been assigned to the General Electric Company, and seems to have some bearing on the experiments now being made with reference to the substitution of motor omnibuses for the horse-drawn coaches along Fifth Avenue, New York City.

THE CANADIAN PACIFIC RAILWAY reports expending $635,432 on its commercial telegraphs last year. The stockholders have been asked to approve an agreement for the operation by the British Columbia Electric Company of the Canadian Pacific's Vancouver and Lulu Island railway.

SECRETARY FOR LIGHTING COMMISSION.—The State Lighting Commission has appointed Thomas D. Hoxsey, of Brooklyn, as secretary, to be located at the New York office of the commission, at a salary of $3,000. Mr. Hoxsey is a well-known newspaper man. The Albany and Buffalo secretaries of the commission will be appointed later.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.—This body will hold its annual meeting at Canton, Ohio, November 17 and 18, at which a number of papers will be presented and proposed changes in the constitution acted upon. Mr. Richard H. Probert, of Akron, is president of the society and Mr. Corwin J. Miller, of Canton, secretary.

ILLINOIS STATE ELECTRIC ASSOCIATION.—The Illinois State Electric Association will hold its annual meeting in Peoria, Ill., October 5 and 6, with headquarters at the National Hotel, where the meetings of the association will be held and where arrangements have been made for the display of new and interesting electrical appliances. Several interesting papers will be read on various subjects, important questions will be brought up for discussion, and an entertainment committee will see that the members and visiting representatives of electrical manufacturing houses are kept busy. Mr. D. Davis, of Litchfield, is secretary of the association.

HEATER FOR GLOWER LAMP.—An invention of Wilhelm Boehm, for which a patent was granted September 12, relates to that type of incandescent lamp in which it is necessary previously to heat the incandescent body to a certain elevated temperature before it becomes conducting. For such bodies it is necessary to provide a special resistance in order to prevent their fusion by the action of an excess current. The present inventor proposes to use the preheating resistance as a ballast after the lamp is in operation. The heater and the incandescent body are placed in parallel at starting, but are placed in series automatically when the incandescent body becomes a conductor and current flows through it.

A PECULIAR IRISH CITY.—Recently the Corporation of Limerick, Ireland, at a special meeting held to consider the project of a street railway line, voted to reject the plan for such a system because of popular opposition. On the evening of the meeting bands paraded the streets and played outside the council chamber to emphasize the opposition of the working community, and especially the cab drivers, to the undertaking. The counsel for the Great Southern and Western Railway Company also was present to object on the part of his company to the proposal. The solicitor for the promoters agreed to drop the haulage portion, but asked that a committee be appointed to investigate the details, and in the event of the haulage scheme not being found agreeable, to go at least into the passenger proposal. On final vote, however, the entire scheme, both passenger and haulage, was rejected. The population of Limerick by the census of 1901 was 38,000 and of the parliamentary borough 46,000. The distance roughly from end to end of the city is two miles. To traverse this length one must either walk or pay a generous cab fare.

TELEPHONE MANNERS.—An excellent article appears in the New York *Mail and Express* as to the offenders who make telephone service slow by their refusal to recognize the rules, which after all are only the reasonable etiquette of good manners. One of the offenders is the man who calls you up and then insists on knowing who you are before disclosing his own identity. Another is the man who, having called you up, keeps you waiting several minutes before he deigns to start the conversation. Such "hogs" do much to frustrate the best efforts of the telephone exchange and the operators, and as the article says: "Why should the graces of civilization be sacrificed to the horrid uses of the telephone? A slump back to barbarism is too high a price to pay for that convenient instrument. All persons who desire to preserve the remnants of civilized conduct which thus far have escaped destruction at the hands of the selfish animals who commit their ravages by telephone should organize themselves into a vigilance committee to reform or exterminate these enemies of the human race."

Electrical Engineers of the Times.—XXVIII.

PROF. A. H. FORD.

Arthur Hillyer Ford was born in Chicago, Ill., February 6, 1874, and spent his boyhood days in Waupun, Wis., where he completed the second year in the High School. He attended the Wisconsin Academy, Madison, Wis., for one year, and was a student in the preparatory department of Washburn College, Topeka, Kan., for a year. In the fall of 1891 he entered upon the electrical engineering course at the University of Wisconsin, from which he was graduated with special honors in 1895, receiving the degree of Bachelor of Science. He was elected Fellow in Electrical Engineering at the University of Wisconsin in 1895 and again in 1896, and received the advanced degree of Electrical Engineer in 1896, and was elected Fellow in Electrical Engineering at Columbia University in 1897.

Mr. Ford spent the summer months of the year 1898 in the testing department of the General Electric Company at Schenectady, N. Y., after which he accepted a position as draughtsman with the Warren Medbury Company of Sandy Hill, N. Y. In February, 1898, he accepted a position with the Western Electric Company in the dynamo testing and designing department of the Chicago factory, and later in the factory engineer's office of the New York plant.

PROF. A. H. FORD.

While a graduate student at the University of Wisconsin, Mr. Ford showed a faculty for teaching and decided to make teaching his profession if opportunity presented itself. Being offered the position of acting professor of electrical engineering at the University of Colorado, in August, 1900, he served for one year as head of the Electrical Department in the absence of the regular incumbent. In June, 1901, he was elected professor of electrical engineering at the Georgia School of Technology, Atlanta, Ga., which position he now holds.

Mr. Ford has devoted much study to the magnetic properties of iron as affecting the characteristics of electrical apparatus, and in a number of publications has treated these features. In 1896 the University of Wisconsin published an article by him describing "A Complete Test of Modern American Transformers," which attracted considerable attention on account of the bearing of transformer losses on central station economy. This article was one of the earliest to lay stress upon the question of all-day efficiency. On April 25, 1900, Mr. Ford presented before the American Institute of Electrical Engineers in a paper on "Hysteresis in Iron and Steel," a study of the effect of chemical composition on the increase in hysteresis loss in a transformer core with time.

Prof. Ford is a member of the American Institute of Electrical Engineers, the American Association for the Advancement of Science, and the Society for the Promotion of Engineering Education.

New Power Plant of the Brooklyn Rapid Transit Company.

THE new power plant of the Brooklyn Rapid Transit Company now being erected on the Wallabout Canal, which will be known as the Williamsburg Power Station, forms the sixth independent generating station supplying power to the Rapid Transit Electric Railway system. Four of the stations are of the older type with direct-current machinery, as follows: The Third Avenue Station, taken over with the old Atlantic Avenue System; the Thirty-ninth Street Station, taken over with the old Nassau system; the Fifty-second or South Brooklyn Station, and the Kent Avenue or Eastern District Station. The fifth generating plant is the large central station plant at Third Avenue, which has now been in operation about three years. This station is of modern design and contains eight 4,000-hp vertical engine generating units. In this station high voltage three-phase currents are generated for transmission to seven sub-stations, the current being in these transformed to direct-current and distributed to surface and elevated networks of the company; several additional sub-stations are contemplated, to be supplied with power from the Third Avenue Station.

The new Williamsburg Station adjoins the old Kent Avenue Station with a frontage of 199 ft. on Kent Avenue, and 257 ft. on the Wallabout Canal, opposite the Navy Yard. The building is divided by partitions at right angles to Kent Avenue into a turbine room 83 ft. wide next to the old plant, and a boiler house 125 ft. wide. The station has been laid out to accommodate ultimately nine steam turbine generating units, one of 5,500-kw capacity and the other eight of 7,500-kw capacity each, thus giving a total station capacity of 65,500 kw, or with a 50 per cent overload rating of about 100,000 kw. At first only three turbines will be installed, two of which will be of the Westinghouse-Parsons type, and the other the new turbine of the Allis-Chalmers Company. A comparison of the generating floor space with that of the Third Avenue central station is interesting as showing the smaller floor area required for steam turbines. In the latter station the engine room occupies nearly 60 per cent of the total ground plan and the boiler room 40 per cent, whereas in the new station this proportion is exactly reversed.

The turbine section of the building includes an 18-ft. basement for condenser apparatus. The main turbine room has a clear height under roof trusses of 83 ft. On the north side are five mezzanine galleries for the electrical switching equipment and a storage battery; on the Kent Avenue side a stage of mezzanine galleries will be devoted to office, locker and toilet rooms and to mechanical and electrical laboratories. The turbine room is traversed by a 50-ton Shaw traveling crane of 62 ft. span.

The station is designed for 36 Babcock & Wilcox boilers on each of two boiler floors, or 72 in all; the initial installation, however, will consist of 36 boilers, and only two of the three chimneys ultimately required are now being erected. Each boiler will be of 650-hp capacity and designed to deliver steam at 200 pounds pressure; superheaters will raise the temperature of the steam 100 deg. above saturation. Both natural and forced draft will be provided, the latter permitting of the use of low grades of fuel. For the forced draft supply there will be installed two Sirroco blowers of 90,000 cu. ft. capacity per minute for each row of boilers. These fans, which will be fitted with cases and driving engines by the B. F. Sturtevant Company, are to be located on elevated platforms at the sides of the boiler rooms or in the basement, delivery being through ducts leading down to cross flues beneath the ash pockets. Sufficient capacity is provided in each blower to supply the entire six boilers to their maximum if at any time this is found necessary.

Coal will be delivered to the new station from barges in the Wallabout Canal, which will be unloaded by a coal tower, whence cars upon an elevated cable railway will distribute it in the pockets over the boiler room. The tower will consist of a steel structure, 100 ft. long, 25 ft. wide and 133 ft. high, containing the barge unloading apparatus, coal receiving bins, crushers, etc., together with an ash handling and storage equipment. The coal unloader hoist jibs, of which there are two, one at either end of the tower, are to be located 73 ft. above bulkhead level, from which the lift to the receiving bins will be 57 ft. The small receiving bins deliver to coal crushers and from thence the coal is elevated 115 ft. by two lines of bucket conveyors to the top of the structure for delivery to the automatic cable railway cars. Of the latter there are to be five of 2½ tons capacity each, which will be loaded at a rate of about two per minute, giving thus a total capacity of about 300 tons per hour. The cable railway crosses to the boiler house by a bridge and makes a complete circuit of the coal pockets above the boilers.

The coal unloading tower equipments are of the two-man type, and each is operated by a combined hoisting and trolley engine set. The buckets are of the improved Rawson type, each of 1¼ tons capacity, and the coal crushers will be of the single-roll swinging-block type. The elevating conveyors will be equipped with a variable-speed motor drive, the capacity guaranteed for the system to be the handling of 300 to 350 tons per hour. The entire coal handling equipment, together with the ash handling apparatus, is being supplied by the Mead-Morrison Mfg. Co., New York.

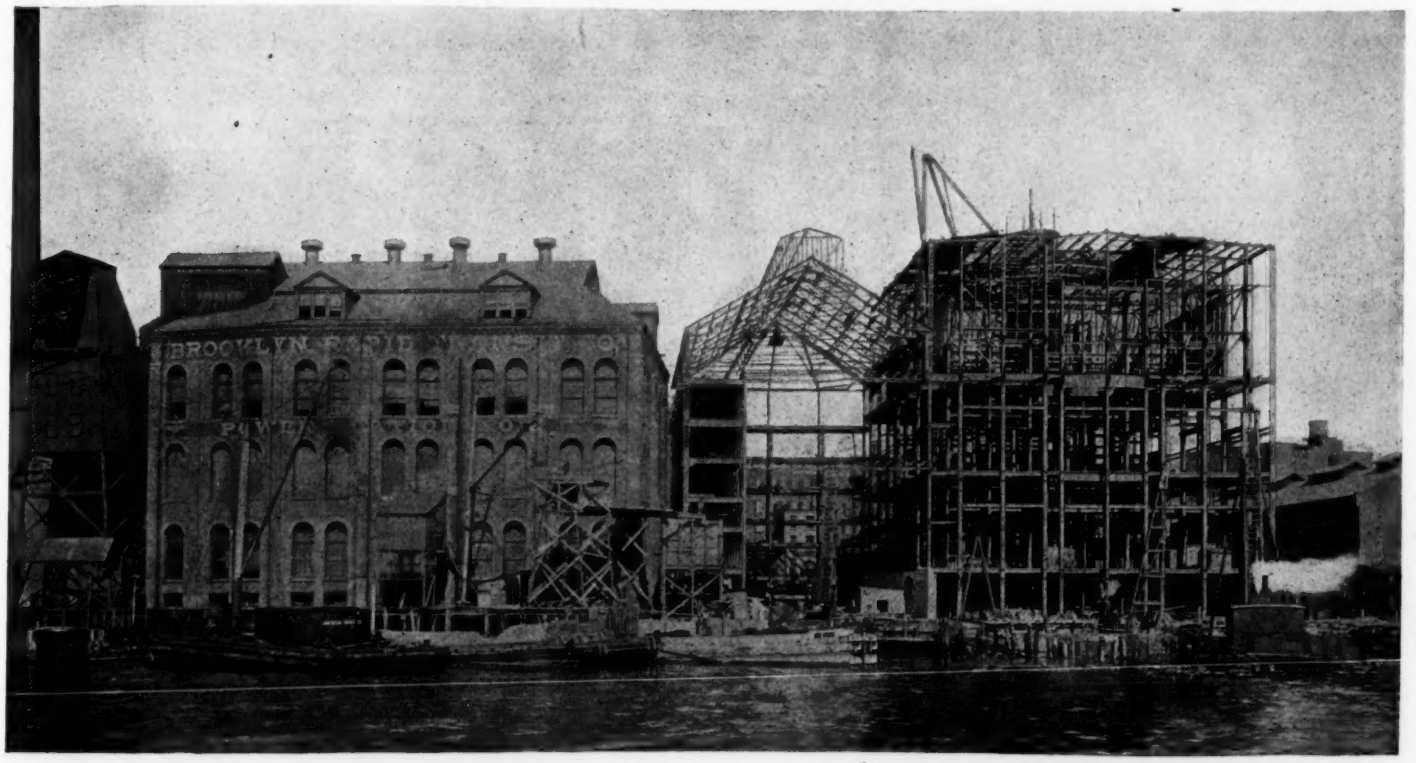


FIG. 1.—NEW WILLIAMSBURG STATION UNDER CONSTRUCTION.

The ash-handling system will comprise a line of narrow-gauge railway cars passing underneath the ash chutes in the boiler house basement, which will deliver the ashes to an elevating conveyor in the coal tower, raising them to a 1,000-ton ash storage pocket. Cast-iron chutes are carried from the furnace ash bins of the boilers upon both floors down to outlets over the track for dumping direct to the cars. The latter will be of the V-bottom dumping type, and will be hauled by a 6,000-lb. electric locomotive, which is capable of drawing a total load of 14,000 lbs. at a rate of about three miles per hour up a five per cent grade. The ash elevating conveyor is of the bucket type and is designed to deliver at a rate of from 50 to 60 tons per hour from the receiving bin to the storage pocket. The latter is provided with outlet spouts for delivery either to wagons or boats in the channel.

For the initial installation there will be three vertical, direct-acting, cross-compound Blake simplex boiler-feed pumps of the center outside-packed-plunger pattern. These pumps are designed for delivering against a pressure of 240 lbs. when operating with 175-lb. steam pressure and no suction lift, and are designed for delivering 500 gal. per min. with a piston speed of 75 ft. per min. An open feed-water heater of the Cochrane horizontal cylindrical feed-water heater and purifier, built by the Harrison Safety Boiler Works, Philadelphia, Pa., will have a capacity for heating 400,000-lb. of water per hour from 100° to 207° Fahr. This heater is 15 ft. long and 8 ft. in diameter inside, and has a carrying capacity of 376 cu. ft. per hour. It is fitted with 20 trays for the deposition of impurities, and has the usual coke bed filter for purification of the feed, while a Cochrane oil separator incorporated in the heater

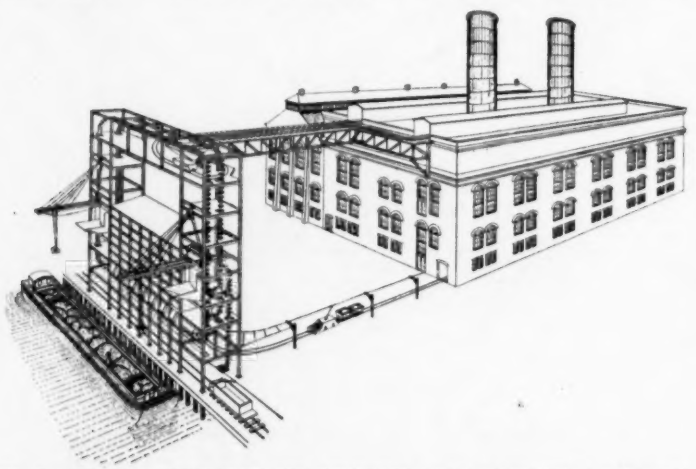


FIG. 2.—GENERAL VIEW OF PLANT, SHOWING COAL-HANDLING APPARATUS.

prevents contamination of the feed by lubricating oil from auxiliary engine cylinders. There will also be two closed Wainwright heaters, each 48 in. inside diameter, with 800 1-in. corrugated copper tubes 7 ft. 6 in. long, giving thus a heating surface of 1,333 sq. ft. The tubes are divided into four groups through which the water passes in succession, and baffles are used to cause the exhaust steam to pass in counter-current to the feed water.

As previously stated, the station has been laid out to accommodate ultimately nine steam turbine generating units, one of 5,500 kw capacity, and the other eight of 7,500 kw capacity each. The use of turbines of the 7,500 kw ratings and the 50 per cent overload capacity mark an important departure, as each turbine at 50 per cent overload will be capable of delivering 15,000 hp, which is the greatest amount of power ever developed in a single prime mover in stationary practice.

The new 7,500-kw Westinghouse turbine units will differ in some details from their well known 5,000-kw capacity machines, but the same general type and form of unit is preserved in the new design. The blades are to be made longer, and other modifications of a minor nature are to be incorporated, which materially affect the increase of capacity. The new Westinghouse unit will be 50 ft. long, 17 ft. wide and 15 ft. high, occupying thus a total floor space of 850 sq. ft., or 0.113 sq. ft. per kilowatt capacity. It will thus be only about 4 ft. longer than the 5,000-kw turbine unit, while the width will remain practically the same. These turbines will operate at 175 lb. pressure with 100 deg. of superheat, and the speed will be normally 750 r.p.m. Under the above conditions and a vacuum of 28 in., the steam consumption at full load will be approximately 16 lbs. per kw-hour. An important feature of the new design is that its best economy will be secured around full load, although heavy overloads may be carried at any and all times without material sacrifice of efficiency. The design also permits of the turbine developing its full-rated load non-condensing.

The turbo-generators connected to the above units will be similar to the former standard Westinghouse designs for use with turbines, with the exception that they will embody a new enclosed construction which will be effective in entirely eliminating the hum peculiar to high-speed turbine generators. They are of the four-pole type and are wound so as to deliver either 6,600 or 11,000 volts. As connected they will deliver three-phase currents at a voltage of 6,600 and a frequency of 25 cycles per second. The stationary armatures will consist of a cast-iron frame with laminated core and coils set in partially closed slots. The field cores will be built up of steel castings, with slots closed by brass wedges. Their efficiency will approximate 97.5 per cent at full rated load, and they will be able to sustain 50 per cent overloads for three hours without dangerous rise of temperature of windings.

The Allis-Chalmers 5,500-kw turbine, which will run at a speed of 750 r.p.m., is direct-connected to a rotating-field, three-phase, 25-cycle generator. The turbine was built at the West Allis works of the Allis-Chalmers Company, and the generator was built at its Bullock works, Cincinnati.

The steam turbine is of the horizontal, parallel flow, reaction type, being very similar in general construction and principle of operation to the well-known Parsons type. One of the principal improvements made by the Allis-Chalmers Company in the construction of its turbine is that of the blading, which is manufactured by special machine tools constructed for this purpose.

One of the widest departures from previous practice is in the method of securing the blades to the turbine spindle and cylinder, the blades being first inserted in a foundation ring which is afterward secured in the turbine in such a manner as to withstand safely the high centrifugal force, instead of inserting the blades individually in the turbine.

Another improvement is the addition of a channel-shaped shroud ring which is riveted to the ends of the blades, thereby stiffening them and preventing the effects of vibration in weakening the blades. The flanges of this channel strip are made very thin so that if from any accidental cause the rotating and stationary part should meet the flanges of the ring will come in contact without damage to the turbine, as distinguished from the case where the blade ends are left naked without protection. The use of this protecting shroud ring enables the turbine to be built with less clearance between the rotating blades and the stationary cylinder than would be possible without this device.

The speed of the turbine is regulated by a spring-loaded centrifugal governor acting through suitable mechanism on the steam inlet valve. The turbine is lubricated by a thorough system of piping whereby the oil is forced by a centrifugal pump, which is driven by the turbine, through a system of pipes to the bearings, thence through a large cooler and used over and over again. There is a separate direct-acting steam pump in the oiling system for use in starting up the turbine, or to be used in case of emergency.

The turbine and generator shafts are connected by an enclosed flexible coupling and are carried in ball and socket bearings lined with a special hard babbitt metal. The generator is constructed with special reference to safety of operation at turbine speed, and with thorough ventilation. A new method is employed for supporting the ends of the coils of the revolving field and at the same time thoroughly ventilating it.

The whole unit of turbine and generator measures 47 ft. 1 in. in length over all. The outside diameter of the stationary armature of the generator is 13 ft. 4 in. The greatest outside diameter of the turbine casing over the flanges at the low-pressure end, is 8 ft. 10 in. The highest part of the unit, namely the top of the generator, stands 11 ft. 6 in. above the floor level.

For each of the turbines there is to be installed beneath them in the basement a Worthington surface condenser, with a two-stage turbine hot-well pump, motor driven, and a horizontal rotative dry vacuum pump. The circulating water will be handled by volute circulating pumps, direct-driven by vertical compound engines, short direct connections being had to the inlet and overflow tunnels beneath the basement floor. The condensers are rectangular in section, that for the 5,500-kw turbine having 22,000 sq. ft. of surface, made up of 1-in. tubes, 17 ft. long between heads, over which the

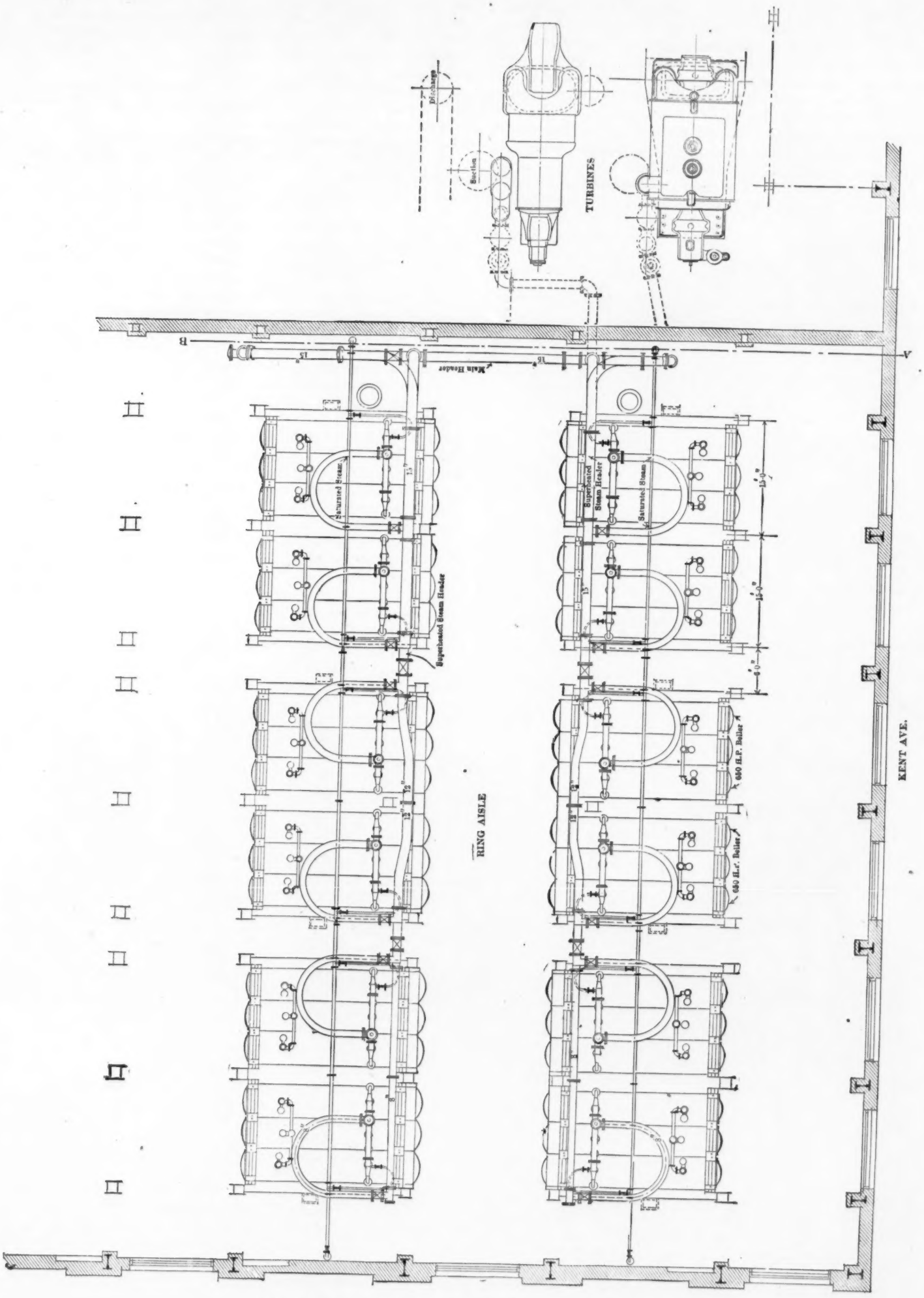


FIG. 3.—PLAN OF WILLIAMSBURG POWER STATION.

steam makes three passes. It has a capacity, when supplied with circulation water at 70° Fahr., of maintaining one pound absolute in the exhaust passages when condensing 150,000 lb. of steam per hour. The condensers for the 7,500-kw units will be of the same general design as the smaller one, but with 25,000 sq. ft. of surface; it is of the same length and height, but sufficiently wider to accommodate the increased tube surface.

The electrical control equipment for the new plant will be similar to that in general use in three-phase generating stations of this type, some changes, however, being introduced in minor details where practice has indicated the possibility of improvement. The high-tension system, including oil switches. and control and switching

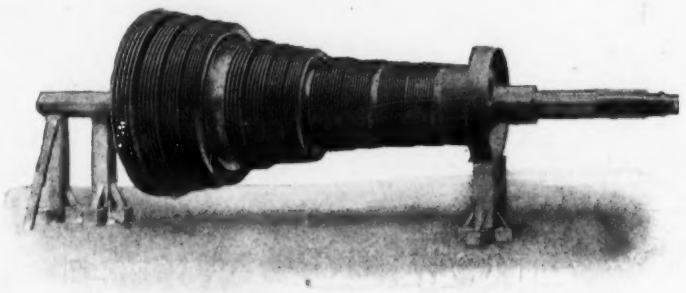


FIG. 4.—ROTOR OF ALLIS-CHALMERS TURBINE.

apparatus, will be operated similar to that in the Third Avenue Central Power Station, although, instead of being arranged at one end of the building, this equipment will be located in the mezzanine galleries, of which there are five extending along the entire north side of the turbine room.

The arrangement of the electrical galleries adopted is novel. The space under them on the first floor level adjacent to the turbine room will contain the exciter and lighting units and associated control apparatus, and also the lighting and power switchboard panels. The balance of this space and the first mezzanine will be devoted to the cable ducts, while the second mezzanine gallery is to contain the high-tension feeder switches by which the feeders are connected to the group buses. The third mezzanine gallery will carry the control boards and operating stands, which will be located near the middle of the proposed building in the form of an open balcony overlooking the entire turbine section. The potential transformer equipment and the equipment of generator and feeder buses will occupy the rear of this gallery, the latter to be encased in cells of brick wall and alberene partition construction, with wired-glass doors in front and rear where the connecting cables are attached through disconnecting switches. The control boards are to be arranged in two rows of semi-circular shape, the generator panels in front and the feeder panels at the rear. In general, the equipment of the panels will be similar to those in the Third Avenue Central Station. The individual generator and group feeder oil switches are to be located upon the fourth mezzanine gallery, from which leads are carried down through the series transformers to the feeder switches.

The system of connections for the switching system provides for two 1,200-amp. non-automatic switches in series between each generator and the generator bus, while the feeders are supplied in groups of four by a 600-amp. main group-feeder oil switch. The buses are in all cases sectionalized, the generator buses having been planned so that but three or four generators will be assigned to each section, tie switches being provided to connect the various sections together if desired. There is to be only one section of the generator bus installed at present, while there will be three of the feeder buses, each supplying four feeders. The feeder switches, located on the second mezzanine gallery, are equipped with relays for automatic tripping under overload.

The exciter and lighting system will consist of three 150-kw units, two being motor-generator sets and the other a steam engine-driven unit, delivering direct current at from 125 to 150 volts; this is to be supplemented by a storage battery which will float upon the system constantly, but not so much in the sense of reserve capacity as for security from interruptions, which it is designed to prevent absolutely. The battery which will be installed on the fifth mezzanine gallery is to be of 2,000 amp. discharge capacity and will be operated without end-cell switch regulation. A novel form of direct-current reverse relay, or circuit-breaker, will be used in this connection on all the motor-generator leads to prevent a destructive return flow from the battery to a motor-generator in case it becomes inoperative. This relay is designed to open the circuit on any reverse flow from the bus to the machine equal to or above one-half its full-load capacity, although it is entirely inactive when current is flowing properly from the machine to the bus, or even at heavy overloads.

The type C oil switch of the Westinghouse Electric & Manufacturing Company will be used as standard throughout the new station, as well as also in all new high-tension work. These will be automatically controlled by the General Electric diaphragm-type, inverse-element overload relays, which are designed to break the circuit more quickly in proportion as the overload or short-circuit is heavier or more severe. The entire switch and control board equipment is being supplied and installed by the Westinghouse Electric & Manufacturing Company.

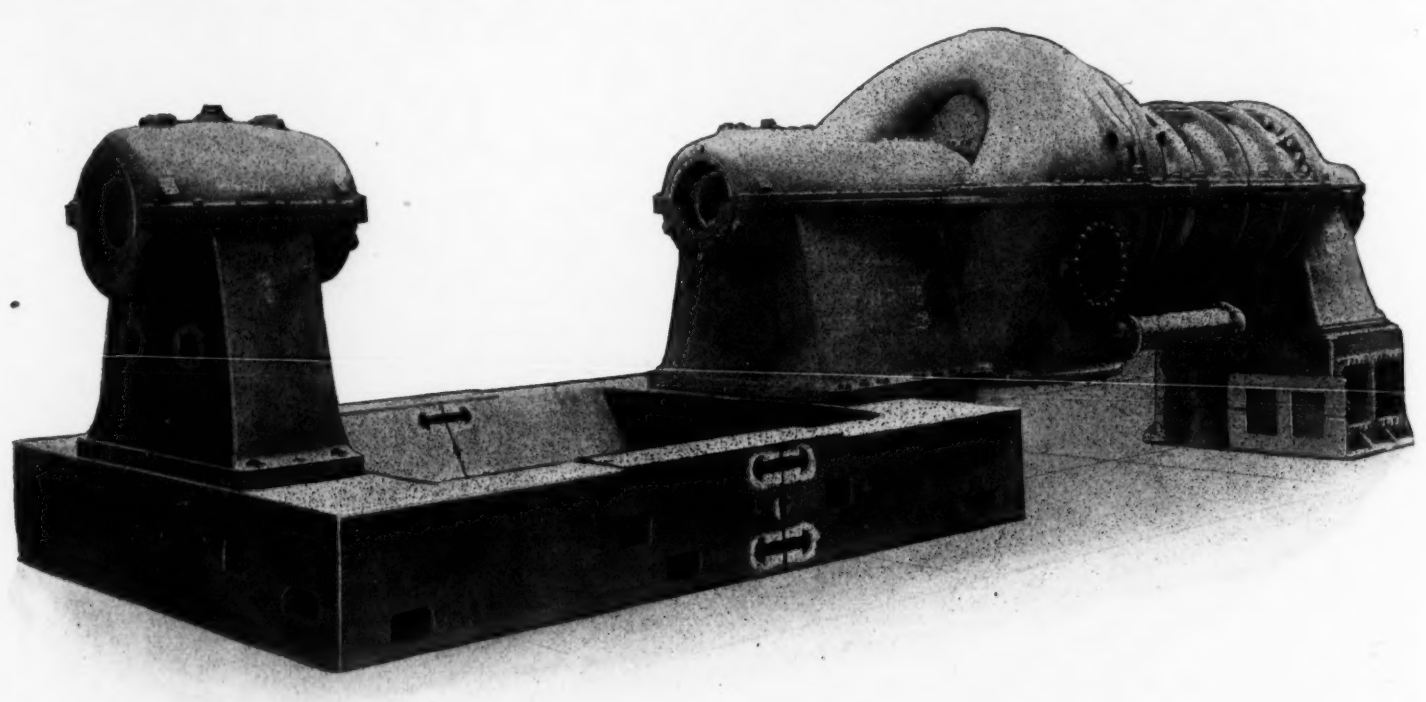


FIG. 5.—ALLIS-CHALMERS TURBINE, LOOKING FROM GENERATOR END. GENERATOR BED PLATE IN FOREGROUND.

This station is being built by the Transit Development Company, an equipment and operating company subordinate to the Brooklyn Rapid Transit system. In the details of design and construction the latter company has been represented by Edwin W. Winter, president; C. E. Roehl, electrical engineer, and R. C. Taylor, mechanical engineer. Thomas E. Murray has acted as consulting engineer.

British Law on Live Rail Accidents.

BY W. VALENTINE BALL, M. A. (Cantab), BARRISTER-AT-LAW.

WITH the introduction of railways worked by electricity on the live-rail system a very interesting problem arises as to whether and how far the company is held responsible for the accidents which happen to persons on the line. At first sight it may appear to be a simple matter to answer this question; but it is not so easy as it seems, as much depends on the answer to a further question, namely, what right had the injured person to be where he was? Although divers accidents from electric shock have occurred since the live-rail was introduced in England, no case in which the question of liability of the railway company has been considered has yet come before the courts. The subject must, therefore, be approached from the standpoint of first principles. And first with regard to persons employed on an electric railway by the company. If any such person meets with an accident by coming into contact with a live rail there is an English statute known as the Workmen's Compensation Act, which would clearly give him a right to claim damages, unless it could be shown that the workman had brought about the accident by his own serious and wilful misconduct. Apart from this and certain other statutes, of which the most important is known as the Employer's Liability Act, there is no rule of the English common law which would entitle a workman to compensation *qua* workman. In fact, the English law as (apart from statute) with regard to the liability of an employer for injuries sustained by a workman is similar to that which, according to Mr. Croswell, obtains in America.

That author states: "As to the liability for an electric (The Law of Electricity (1895) sec. 266) company to its employees for defective construction and maintenance, the leading rule is, as in other branches of the law of master and servant, that the employee in entering the business, accepts all the obvious, incidental and natural risks thereof, and the company is not liable for injuries resulting to him therefrom." The risk of injury by shock from a live rail could hardly be described as anything but an obvious risk, especially if the company took the precaution of posting warning notices in places where the employees were likely to cross the permanent way ("or the road bed") on the level. Since the above work was published special acts dealing with employers' liability may have passed in some States of the Union; but as we are not immediately concerned with the statute law which makes special provision for workmen, we may proceed to consider the liability of an electric railway company in respect of passengers and other persons who may be exposed to danger.

Inasmuch as a railway company are the owners of the land on which their lines are laid, they are entitled to restrain persons from trespassing upon it; if a person does trespass on the line the company is under no duty to take precautions for his safety. In an English case which was decided long before live rails were heard or thought of, a man was found dead on a railway, but there was no evidence to show how he got there or that, although he was clearly killed by a passing train, the company had been guilty of any negligence. So it is apprehended that if a man were to cross an electric railway at a place where the public were not entitled to cross, and put his foot on the live rail he could bring no action against the company. We have said that there is no English decision to this effect; but in a recent American case, where a man trespassed upon certain property of an electric supply company and came into contact with a naked conductor, he was not entitled to recover any damages.

Different considerations apply (a) to the public who may, at certain places, have the right to cross the line on the level and (b) to passengers who may be expressly or implicitly requested to cross the line for the purpose of getting from one platform to another. In all these cases it is clearly the duty of the company to take precautions. For instance, it would be their duty to guard the naked conductors with wooden rails in order to prevent a person stepping on the metal. It may here be mentioned that the Board of Trade in England (this being the Government department which has worked in these matters) have made regulations to this effect; but they have declined to call upon electric railway companies to guard the naked conductors throughout their length. Failure to post warning notices would probably be regarded as negligence on the part of the company. The law upon this branch of our subject has been thus stated in a text book recently published in England: "Carriage by Railway," by H. Disney, Barrister-at-Law: "If a person is wrongfully on the premises of a railway company there is no duty upon the company to warn him of even concealed dangers. He comes entirely at his own risk, and, though nothing may be done with the intention of injuring even a criminal (as by setting a man-trap to catch a thief), the company is under no obligation for negligence to a trespasser. Thus if a person were in a train with the fraudulent intention of traveling without paying, the company would probably not be responsible if that person were injured by negligence. Again, a person trespassing on the line could not make the company answerable for injuries received while so trespassing.

Gas Arcs and Electric.

An interesting paper on "Gas Arcs" was presented before the recent meeting of the Pacific Coast Gas Association, at San Francisco, by Mr. W. M. Kapus. We give below an abstract of the paper together with a report of the discussion which followed its reading.

With the gas arc at the present time a gas company has great possibilities by which it can largely increase its output, and can obtain a certain class of commercial lighting which would otherwise be impossible to obtain. Among the lighting companies the sale of the gas arc is advocated chiefly by those companies dealing exclusively in the sale of gas, while companies which operate combined gas and electric plants do not take so kindly to the gas arc. Gas companies which have followed a method of free installation and maintenance have met with much success in introducing the gas arcs. The cost of a regular four-burner arc complete with best grade of mantles is not over $7.50. This arc can be installed for the price of $12 and still leave a margin between the net cost and the net selling price to cover the expense of installation and a small profit besides. The gas company does not derive its benefit from this small profit, however, but from the increased sale of gas which cannot be obtained unless gas appliances are within the reach of all. Even a reasonable loss on the sale of the appliance if encountered in order to create a greater demand for gas will appear as a very small percentage on the cost per 1,000 cu. ft. on the annual output as compared to the volume of new business that can and should be thus obtained.

It is of great assistance to the representatives of a company when endeavoring to set forth the advantages of an arc, to be able to state that after the first cost the company does the rest. The author asserts that experience with 3,000 arcs has shown that the total cost for maintenance averages about 25 cents per arc per month. Gas arcs constructed with a separate adjustment for each burner are far more satisfactory than those equipped with a single adjustment for two or more lights. When the arcs are used in exposed locations the only precaution that is necessary is the proper adjustment of the pilot light, in order that it will not be extinguished when the lamp is not in use and allow unburned gas to escape.

In opening the discussion of the paper, Mr. E. C. Jones stated that experience proves that the gas arc furnishes the best means of lighting a store, and that its use will interfere seriously with the electric light business. Mr. Newbert remarked that it is important to consider the fact that where the fixtures are already in place single burners are cheaper to install than multiple burners, and that the greatest competitor to the electric lamp is the improved single burner. Mr. Colquhoun said that the gas arc is much more economical than single burners. The small burners consume about 5.5 to 6 cu. ft. of gas per hour, while the four burners on a gas arc use about 21 cu. ft. There is, however, danger of breaking the mantles of a cluster when one is being replaced. A better distribution of light can be obtained from single burners than from arcs.

The Single-Phase Railway in Practical Operation.

IN ORDER to show with what success from an operating point of view the several single-phase railways now installed in this country have met, an account is given below of operating experience with the three equipments of this kind which for some months have been in regular service. Each of these equipments was described at length in these columns at the time of its installation. In the issue of last week was given an account of a fourth single-phase railway which has recently been placed in operation between Marietta and Atlanta, Georgia. Although this road has as yet not been in service for a sufficient length of time to furnish any information as to changes, if any, which have been found desirable in operation, a comparison of its equipment with that of the earlier roads may serve to show the trend of the development in single-phase railways.

SCHENECTADY-BALLSTON LINE.

In our issue for August 27, 1904, was given a description in detail of the single-phase equipment used over a portion of the Schenectady-Ballston Railway. This equipment has been in practically continuous operation during the past year for the stated purpose of determining just what defects would develop in actual service. It is worthy of note that, although the armatures differed inappreciably from those used in direct-current practice and were provided with no auxiliary means for preventing sparking, they have given excellent satisfaction. The effectiveness of the initial design may be learned from the fact that the new motors which are now being installed differ from the earlier ones practically in respect only to the speed. The first motors operated at a normal speed of 1,500 r.p.m., while the motors of the latest equipment have been designed for 1,350 r.pm. This change has been found desirable on account of the short life of the brushes at the higher speed.

It will be recalled that the low voltage for the motors on the initial equipment was obtained from a single tap of an air-cooled transformer, the motors being operated on the series-parallel method, with and without resistance, for variations in speed. On the equipment now being installed, the motors are connected permanently four in series, and the control of the speed is accomplished by varying the e.m.f. impressed upon the circuits of the motors. The variable voltage is obtained from five intermediate points on an oil-insulated self-cooling auto-transformer, referred to as a "compensator." The object in changing from an air to an oil transformer has been to avoid the dust and moisture which was found to collect in the ventilating ducts in the air-cooled transformer. The oil transformer differs inappreciably in design from the standard stationary apparatus, except that it possesses only a single winding, and is mounted under the car in such a position as to occupy the least possible space in the vertical direction. The oil is contained in a strong, well-corrugated sheet-steel case, which is held in place by means of rubber washers which serve to deaden the shock due to the attempted movement of the liquid when the car is accelerating or retarding.

An interesting feature of the equipment is found in the method used for changing from one tap on the auto-transformer to another without opening the circuit to the motors or short-circuiting the intervening coil on the transformer. In passing from a tap to the one next higher in voltage, an impedance is first connected between the two taps. Then the connection to the lower-voltage tap is broken, leaving the impedance in series with the motor circuits. Finally the impedance is short-circuited, leaving the motor circuits connected directly to the higher-voltage tap. It may be of interest to observe that if the impedance is of such a value that when connected between adjacent transformer taps, it takes exactly the same amount of current at the same lag angle as do the motor circuits when connected to the lower-voltage tap, then there will be absolutely no change in performance of the equipment and no sparking whatsoever in the controller when the lower-voltage tap is disconnected. There is an increase in current and a corresponding change in acceleration when the impedance is short-circuited, but the sparking in the controller is practically eliminated. The impedance referred to consists of the blow-out magnet coils for each tip of the controller and a certain additional resistance. It is evident, from the description just given, that the blow-out magnets are in circuit only when the controller is being changed from one running position to another. A notched wheel on the drum shaft serves to insure that the controller will not be left in an intermediate position, so that the energy lost in the preventive impedance is practically negligible. The method of placing the preventive impedance in circuit between running positions may be learned from a study of Fig. 1.

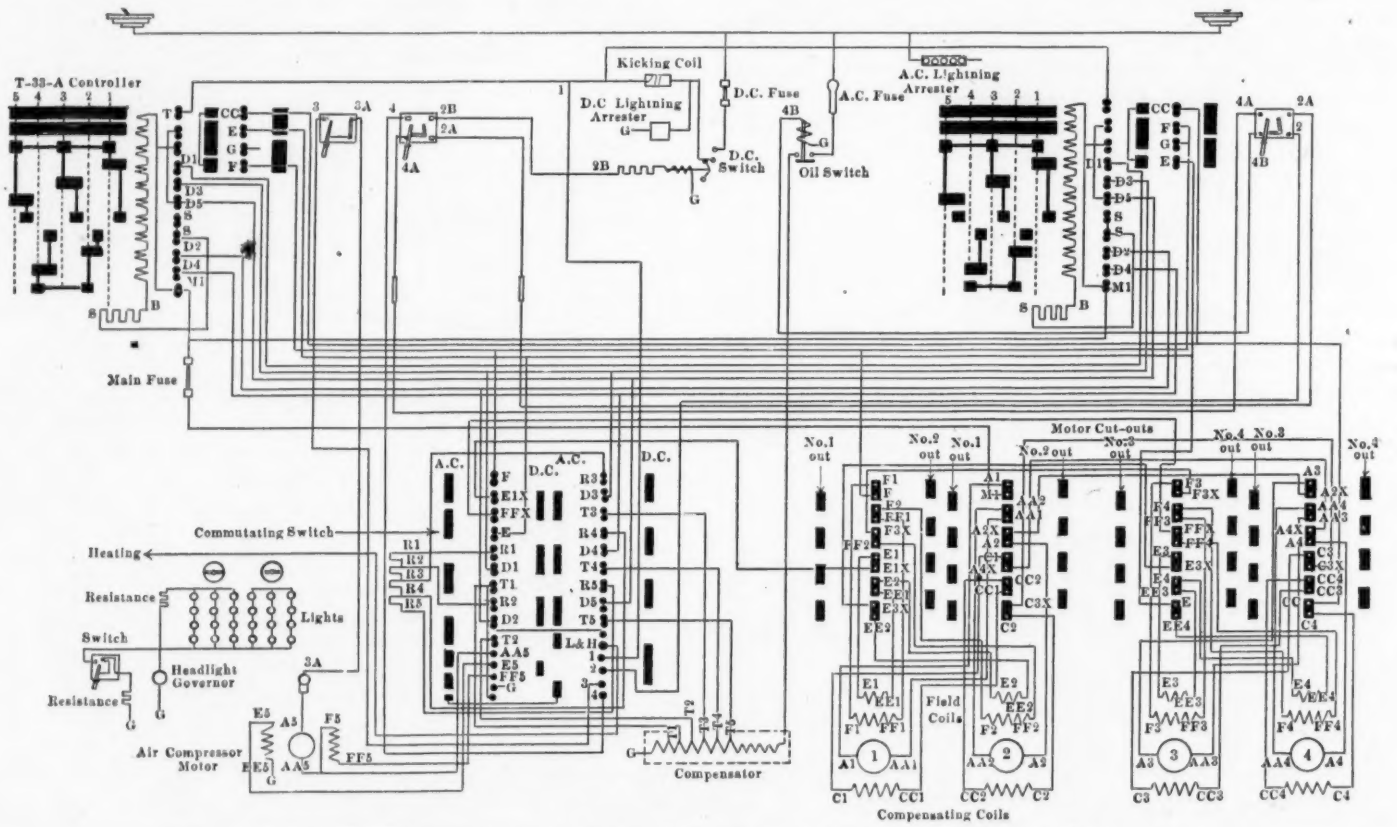


FIG. 1.—CIRCUITS OF CONTROLLER FOR COMBINED DIRECT AND ALTERNATING-CURRENT OPERATION.

or other good insulating substance being upon the rail, the circuit to ground would be incomplete while the metallic frame of the car would be at the potential of the trolley wire, thus introducing a serious danger-to-life element in the equipment. This element has been eliminated in the recent installations by the use in the high-potential circuit of a main-line switch which remains closed only when the circuit to ground is complete. This switch, which is of the oil type and closed by hand, is provided with a retaining coil which receives its current through a circuit entirely independent of the motors, and which loses its strength when the wheels of the car are insulated from the rails.

A characteristic difference between the single-phase motor and either the direct-current or polyphase motor is found in the fact that while the torque of the first machine pulsates with twice the frequency of the alternating current, the torque of each of the other machines is relatively constant. It is evident that the maximum torque exerted at the rim of the car wheels cannot be allowed to exceed the maximum adhesive force between the track and the rails. Since only the average torque is effective in producing acceleration, it would seem that for the same maximum acceleration the single-phase equipment must be much heavier than the direct-current or the polyphase—in fact, if certain modifying features be neglected, it is theoretically impossible for the single-phase motor to produce an acceleration as high as the other machines. Experience has shown that the single-phase motor can be so suspended through springs that the theoretical maximum torque of the machine never reaches the wheels, and the maximum average accelerating torque is but slightly less than that corresponding to the adhesive force at the rails, and the acceleration actually obtained compares favorably with that found in direct-current practice.

As was true of the earlier installation, the latest equipment has been designed for operation by either direct or alternating-current. A change has been made in the new equipment in that for direct-current service the four motors were formerly placed in two groups of two motors in series, and these two groups were connected either in series or in parallel, while in the new equipment all motors are connected permanently in series and plain rheostatic control will be used. It is evident that the elimination of the series-parallel feature of the controller serves to simplify the cross-connecting circuits of the car.

It is believed that the particular service for which the single-phase equipment is preferable to the dirct-current is in connection with long-distance interurban work, in which direct-current will be used only within the city limits where slow speed will be necessary. Obviously such work would seldom require the motors to be placed in parallel. In regard to the disadvantage of having motors in series when the wheels of one may spin and thereby rob the others of sufficient power for acceleration, it is to be noted that the wheels tend to slip only when the car is first started from rest, under which condition the accepted practice with direct-current equipments is to have all of the motors in series. Since the armature of that motor which spins is subjected to an excess of e.m.f., it is necessary to provide each motor with insulation to withstand the highest voltage. It is to be noted, however, that the value of the current to be commutated under such conditions is even less than normal.

The motors are of the conductively-compensated series type, and hence are at once operative by either direct or alternating-current. For alternating-current work it is desirable to have the fields very much weaker than for direct-current work. For this reason the field coils of each motor are divided into two parts which are placed in parallel for alternating current and in series for direct-current. The commutating switch, which is employed for making the changes in the connection of the field coils, serves also to substitute the rheostatic for the variable-voltage control as desired, and to insure that the main oil switch to the auto-transformer is open when the direct-current connections are made, and to hold the main direct-current switch open when the auto-transformer is being used.

The half field circuit of each motor is connected in series with the corresponding half circuits of the other motors, thus forming two separate field circuits for the four motors. The four armatures and the four compensating coils respectively, are permanently connected in series, making only one armature circuit and one compensating circuit for the whole equipment. Since the change of the field circuits from series to parallel connection is accomplished by means of the commutating switch, the wiring of the reversing drum of the controller is as simple as though it were intended for a single motor.

The motor for driving the compressor of the air-brake equipment is of the same type as the main car motors, and is provided with two field circuits which are placed either in series or in parallel by the commutating switch, according to the character of the current by which it is to be driven. This motor is so designed that when the field circuits are in series it may be operated from the direct-current trolley circuit.

The circuits of the new equipment, as now being installed, are shown in the diagram of Fig. 1, which represents also the most recent practice of the General Electric Company with reference to equipments intended for operation by both direct and alternating-current.

INDIANAPOLIS-RUSHVILLE LINE.

The line of the Indianapolis & Cincinnati Traction Company, between Indianapolis and Rushville, Ind., which began operation early this year, is at present the most important of the several single-phase roads in the United States. It is a road operating very heavy cars at very high speeds, the cars weighing about forty-eight tons and running at maximum speeds of about 70 m.p.h. A description of the equipment of this road was given in the issues of this journal for February 18 and March 18, 1905.

Most of this 40-mile road is on a private right-of-way, with a 3,300-volt trolley hung from a catenary wire supported by brackets. The transmission voltage is 16,500. In Indianapolis the cars operate from the regular 525-volt, direct-current trolley circuit. Two different kinds of current supply must, therefore, be provided for on the motor cars. Each car is equipped with four Westinghouse series commutator motors rated at 75 hp each, with compensating field windings. Electro-pneumatic train control is employed. For direct-current operation in the city of Indianapolis, rheostatic control is provided. For operating on alternating-current, voltage control is obtained by using two different taps from the transformer.

The motors have field cores of laminated iron, which fit inside an outer casing of cast steel, which forms the frame of the motor. The field poles are slotted like the stationary armature of an alternator. The main field coils surround the field poles in the usual manner. The compensating windings occupy the slots in the field poles, so that they overlap the field coils. Thus one side of a compensating coil occupies a slot in one pole piece while the other side of the coil occupies a slot in an adjacent pole piece. The armature is lap wound and therefore has cross connections like many generator armatures. The armature winding is connected to the commutator by spark-preventing leads of German silver bars which have the same function as the preventive resistance used in many forms of alternating-current controllers. These leads extend the length of the armature and are placed in the bottoms of the coil slots. The copper windings are connected to the German silver commutator leads at the opposite ends of the armature from the commutator, at which point the cross connections are placed.

A sliding contact bow trolley is used in the country on the high-tension trolley wire. The ordinary wheel trolley is used in Indianapolis. The bow has a flat contact surface 4 ft. long by 5 in. wide, made of an aluminum alloy. It is raised and held against the wire by compressed air.

The results of the first eight months of operation of this road are such as to be most gratifying. Although there have been troubles, as there always are when new devices are being tried for the first time on a large commercial scale, these have all been of minor importance. The important and fundamental troubles, which were most to be feared, have not shown themselves. Sparking at the commutator seems to be less if anything than on direct-current railway motors. Practically all of the troubles experienced can be traced to the necessity for haste in getting out apparatus in order to place the road in operation in a specified time. For example, the motors used were intended for operation by 250 volts alternating current with a non-grounded circuit, or, in other words, on a purely alternating-current system, such as first outlined by Westinghouse engineers. Operating these on a 500-volt grounded circuit, as was necessary in this case, resulted in a number of motor burn-outs, due to insufficient insulation. This trouble was stopped by rewinding the motors with heavier insulation. It is not one that is inherent in the system and there is no reason to expect further unusual trouble from

this source. Tests made to determine the heating of these motors in service show that they are within the safe heating limit. The trouble, therefore, was due entirely to insufficient thickness of insulation.

The sliding-contact bow trolley is proving an entire success and has required much less experimental work to perfect it than was expected. The wearing surface has probably as long a life as would be the case with a trolley wheel under the same service conditions, namely, on 48-ton cars running between 60 and 65 m.p.h., and perhaps even longer. The life of the wearing surface is from one to two weeks, and there is a strong probability that it can be increased by staggering the trolley wire more than at present. The tendency now is to wear grooves in the bearing surface. Even if the sliding bow did not possess a life as long as the trolley wheel, the freedom from the possibility of its leaving the wire at high speeds makes it immeasurably superior to the wheel trolley. The wearing surface of the bow trolleys consists of three pieces of aluminum alloy fastened to a wood back. Two angle pieces which form the edges have about one inch width of wearing surface (see Fig. 1). There is a flat plate three inches wide in the middle. Between the pieces is left a large crack in which grease is placed. The whole wearing surface is liberally greased when in service. These contact plates would last much longer if the wear were more evenly distributed over them. At present a groove usually wears through at one point. By putting in a new piece at this point but little material is needed to make the contact surface nearly as good as new. The tendency of the wire to wear grooves can probably be very much reduced by staggering the trolley wire to the right and left of a center line more than has yet been done. Provision for staggering the trolley wire was made in the design of the overhead work. The insulators which support the catenary cable are in saddles which can be moved either way from the center. Owing to the necessity of operating with the common wheel trolley when the road first started, the trolley wire has not been staggered as much as is possible. The aluminum wearing plates weigh about 5.5 pounds, while a brass trolley wheel weighs about 4 pounds.

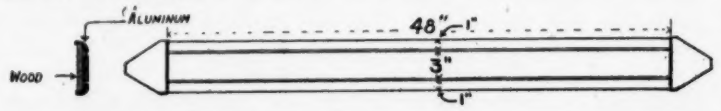


FIG. 2.—PLAN AND CROSS SECTION OF ALUMINUM WEARING SURFACE.

The cars, as now operated when on the 3,300-volt lines, accelerate more slowly while starting than is usual with direct-current cars. The acceleration is very similar to that of a steam train of five or six cars. The acceleration has been placed at a low value in order to reduce the maximum current at the power station. During the latter stages of acceleration the rate of acceleration is more rapid than is frequently found on direct-current lines because of the low line losses. The time tables show that these cars make the fastest schedules of any cars leaving Indianapolis. Express trains make the run of 40 miles from Rushville to the center of Indianapolis in one hour and thirty minutes. Local trains make it in one hour and fifty minutes.

The car equipments have been somewhat improved, lighted and simplified since the description which appeared March 18. In passing from direct to alternating current or the reverse it is only necessary to change from wheel to bow trolley and to throw two small switches in the cab. One of these switches is a part of the master controller and effects the necessary changes in the connections of the control circuits, and the other is an ordinary single-pole, double-throw knife switch, which controls the lighting and pump motor circuits. The air pump motor operates like the main motors on either direct or alternating current.

After all is said and done the surest indication that the single-phase system is believed by the owners and engineers of this property to be the best for the purpose, and that it is more satisfactory than a direct-current system for these conditions is the fact that the company has decided to equip its line from Indianapolis to Shelbyville with the same system. This line is at present a direct-current road which has been in operation several years and was recently bought by the Indianapolis & Cincinnati Traction Company. The decision to replace the direct-current system on the Shelbyville line with the single-phase, alternating-current system was reached only after full consideration by the management of the company and upon recommendation of Sargent & Lundy, consulting engineers. Although this change involved the throwing out of considerable direct-current apparatus, the advantages of the single-phase system were considered by the engineers as ample justification for this move. When the Shelbyville division is changed and the extensions now under way have been completed the company will own over one hundred miles of single-phase trolley wire.

PONTIAC-ODELL LINE.

The Bloomington, Pontiac & Joliet Electric Railway is a single-phase road equipped by the General Electric Company, which began operation between Pontiac and Odell, Ill., March 15, 1905 a distance of 10.4 miles. This equipment was described in the issue of May 6, 1905. The most notable thing about the operation of this road is the uneventful way in which it has maintained its regular schedules from the beginning without any mishaps. From March 15 until about August 1 there was but one car. This left no equipment as a reserve until the second car arrived in July, but the regular schedule of eight round trips per day between Pontiac and Odell was maintained without interruption. In other words, over 23,000 miles was made by this first car in regular service before it was possible to take it off the road to make any repairs that could not be attended to between 9 p.m. and 7 a.m. For over two months there was no car shed, so that inspection and repairs had to be carried on outdoors. This would have been an unfortunate state of affairs had the equipment required much care, but as it did not require this care it speaks more for the satisfactory operation of the equipment than anything else that can be said. Of course, small minor improvements suggested themselves, but on the whole there is very little to say about the performance of the single-phase equipment on this

FIG. 3.—CONDUIT AND FUSE BOX FOR 3,300-VOLT WIRE ON TOP OF CAR.

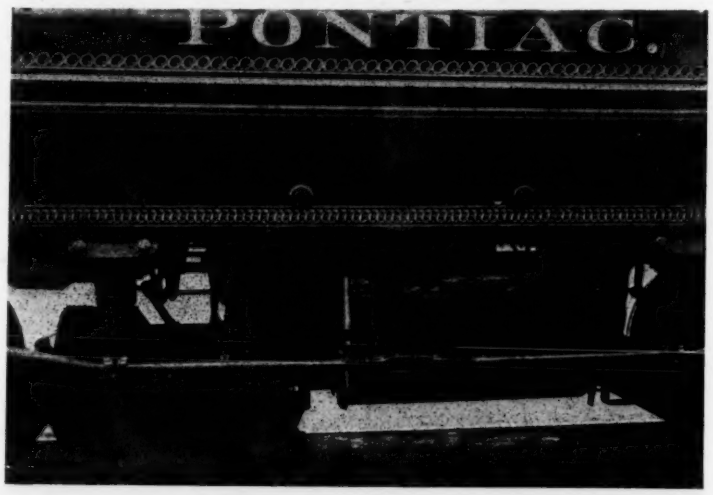


FIG. 4.—COMBINATION ALTERNATING-CURRENT AND DIRECT-CURRENT PUMP MOTOR AND MOTOR CUT-OUT SWITCHES.

road for the reason that it has behaved itself very much as would be true of any good direct-current equipment operating under the same conditions.

The car makes a round trip of 20.8 miles between Pontiac and Odell in one hour, there being eight round trips per day, as explained before. The first car received had motors similar to those on the Schenectady-Ballston line, where this type of motor was first tried. The second car has an improved motor and a different method of control. The first car carried a step-down transformer. This transformer had various taps from the secondary. The controller was arranged to start the motors with a low-voltage tap and gradually increase the voltage by changing the connections to higher voltage taps. To avoid short-circuiting the transformer section between taps at the instant of moving from one point of the controller to the other, a resistance was momentarily placed in series at the instant a section of the secondary was cut in or out. This resistance was in circuit only between the controller points. The new controller is similar to the old except that a compensating coil is used instead of a transformer and various taps are taken from the compensator to the controller.

The new equipment is such that it can be readily adapted to operate also on a direct-current line by the addition of throw-over commutating switches and resistance.

The catenary form of overhead construction is used on this line. Cars are equipped with the ordinary trolley wheel. The original intention was to support the trolley wire from the catenary wire at intervals of 10 ft. As yet much of the line is equipped with supports only midway between the poles. The arrangement seems to work very well. The current is taken from the trolley base in iron pipe conduit to an oil switch located under one platform and from thence to the compensator. The lightning arrester and fuse box are located on top of the car. One of the accompanying engravings (Fig. 3) is from a photograph taken from the top of the car, showing the iron pipe conduit and fuse box. The fuse is of the expulsion type and is placed in a fibre tube. A peep hole covered with mica,

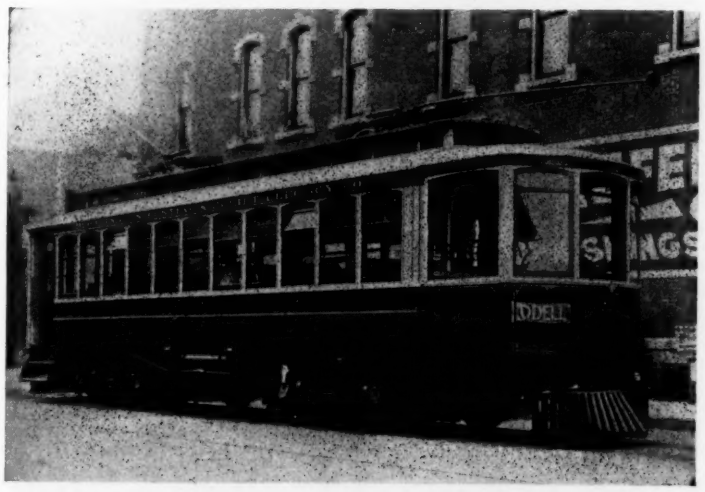


FIG. 5.—VIEW OF EXTERIOR OF CAR.

as seen at the near end of the fuse box in the engraving, makes it possible to see whether a fuse has blown without opening the box. The new car weighs complete about 31 tons and is 41 ft. overall.

The acceleration for the first two or three seconds is not nearly as rapid as with direct-current equipments, but after that the speed increases fully as rapidly as in ordinary direct-current practice.

To sum up, it can be said that this little road in the first six months of its operation, has had a car mileage of over 30,000 miles. It has carried over 60,000 passengers, making schedule speeds including layovers at terminals of 20.8 miles per hour. This is a type of road where economy in construction was of first importance as the population per mile of track did not justify expensive construction. When completed from Pontiac to Dwight, the road will be about 20 miles long. The cost, as nearly as can be judged, will be considerably less than for an equally well constructed direct-current road of the same length.

This road is under the management of J. A. Carothers, president, and F. L. Lucas, general manager. The Arnold Company, of Chicago, acted as consulting and constructing engineers.

Maximum Demand.

BY J. S. CODMAN.

OF late a large number of electric light companies have adopted systems of charging for their product by means of which the rate per kilowatt-hour to a customer decreases automatically as the number of hours used per month or per year of his lights or other apparatus increases.

In all these systems the result is accomplished either by splitting up the charge to the customer into two portions, one based on his demand and the other on his consumption as suggested first by Hopkinson in England; or by charging the customer a high rate for a portion of his consumption equivalent to a certain number of hours' use of his demand, and a low rate for all in excess, as later suggested by Mr. Arthur Wright.*

In this country the first method is used, notably by the Cataract Conduit & Power Co. in selling Niagara power; and a slight modification of it is Mr. Doherty's "Readiness to Serve" system. The second method, in slightly different forms, will be recognized as in use in Boston, Chicago, Cincinnati, Cleveland, Detroit, Minneapolis, St. Paul, St. Louis and New York, and in numerous smaller cities.

Now, although the above mentioned companies, as well as those using the "Readiness to Serve" system, all make a charge to the customer based on his demand, there appears to be a great diversity of opinion among them as to the manner in which it is best to determine the demand, and it is this question which it is the object of this paper to discuss.

METHODS OF DETERMINING DEMAND.

1. *Demand Assumed Equal to Connected Load.*

It is the practice of some companies to assume that the customer's demand is the maximum demand possible, which is, of course, the connected load.

This practice is open to very grave objections and the principal one is that the customer's connected load is an unfair basis of charge. In all these systems under discussion the demand charge is supposed to roughly represent the customer's share of the fixed expenses of the station. Now the fixed expenses of the station are ultimately determined by its capacity and its capacity is determined by the demand of its customers. Further, it is the actual maximum demands of the customers which determine the plant capacity, and not the number of lights they may happen to have connected if these are never all in use simultaneously. One customer's maximum demand may be only one-half his connected load, while another's may be the whole of his connected load. It is manifestly unjust that the demand charge to them both should be the same.

There are also numerous practical objections to the use of the connected load as a basis of charge.

At the beginning of a contract a customer's premises can be inspected, the number of outlets can be counted, the candle-power of the lamps or the capacity of other apparatus connected to each outlet can be noted, and in this way the connected load ascertained. But after the connected load is once ascertained it becomes necessary to require the customer to agree to make no change in his installation without notifying the company. Such a requirement is objectionable, insomuch as it seriously impairs one of the great advantages of electricity, viz., its flexibility of use. The customer cannot change the candle-power of his lamps, substitute a fan or heating device in place of a lamp, nor connect apparatus to an outlet not in use before without consulting the company. Furthermore, in spite of agreements to the contrary, a customer either wilfully or through ignorance of his agreement will often make changes without notifying the company and the latter has no means of knowing when this is done unless frequent inspections of the customer's premises are made. Such inspections are an intrusion on the privacy of a customer and are sure to be an annoyance to him. Also, if they are made frequently enough to be of any use, they become a heavy expense to the company.

Another objection to the use of the connected load as a basis of charge is that it discourages the extensive use of electricity. If a customer is to be charged for every additional piece of apparatus

* "Profitable Extensions of Electricity Supply Stations," read at twentieth convention of the National Electric Light Association in 1897.

connected he will be inclined to connect as few as possible and may even go so far as to use electricity in certain parts only of his premises and in other parts to use other means of obtaining light and power.

It is safe to say, however, that there are but a very few companies in the United States to-day which make use of the connected load as a basis of charge. There are a number that appear to do so, if we judge by their printed forms of contract with customers, but if investigation is made it will be found in almost every case that the word "lights" or "installation" occurring in the contract form is not taken to mean "all the lights" or the "total installation," but is really the customer's maximum demand either estimated or measured by an instrument.

2. *Demand Estimated.*

As just previously stated the estimated demand is used as the basis of charge by many of the companies which appear to be using the connected load, and there are other companies which clearly make the estimated demand the basis of charge even in their printed contracts. This is better practice than the use of the connected load, as the actual maximum demand of the customer is a fair basis of charge.

The principal objection to this practice is, of course, that the estimate is liable to be inaccurate. In the smaller companies a separate estimate can be made for each customer, but in the larger companies it is hardly practical to do this, and it is, therefore, usual to assume the maximum demand for each class of customers as a certain percentage of the load, as for example, 30 per cent for residences, 75 per cent for stores, and so on.

The other objections to the use of the estimated demand are practically the same as for the connected load basis. Since the estimate must be based on the connected load, it is not possible to permit the customer to make changes unknown to the company. This necessitates frequent inspections of the customer's premises, which, as before stated, are an annoyance to the customer and an expense to the company. Also in order to keep the estimate of his demand low the customer will be discouraged from extending his connected load.

3. *Demand Measured.*

Measuring the customer's demand with an instrument is a practice which has numerous advantages, the first of which is that the demand can be obtained with accuracy. Further, a customer can freely make changes in his apparatus installed without stopping to notify the company, as his demand will be recorded on the instrument. For the same reason no inspections of the customer's premises are necessary other than the ordinary ones to see if the installation is safe and that no connections are made back of the measuring apparatus. The maximum demand indicator also acts as a guide in determining the proper size of watt-hour meter and, if this information leads to the use of smaller watt-hour meters there may be a considerable reduction made in the loss due to their slow running or stopping when operating on light load. Another advantage of the measured demand is that the customer need not hesitate to connect as much apparatus as he wishes. The demand indicator will show only the power supplied to such apparatus as may be simultaneously in actual use.

The disadvantage of the measured demand is, of course, the necessity of using an instrument. This means, in the first place, the expense of purchasing and installing, and afterwards expense of maintaining, reading and resetting. Also additional resistance is introduced into the line, absorbing energy and injuring the regulation. Still these arguments could also be urged against the use of a watt-hour meter, and they are not valid if in the actual instruments used these objections are reduced to a minimum, which can be done.

Another objection is sometimes urged against the use of the measured demand. It may happen that a customer on some particular occasion, such as the giving of a ball or other entertainment, may have a demand greatly in excess of what is usual, and it is argued that as on such an occasion the demands of his neighbors at the same time are less than usual, he should not be charged for the unusual demand. Also, if the company agrees to cut out the indicator for such an occasion provided due notice is given, this notice is often forgotten and in any case is a nuisance.

The best way to overcome this objection is to assume the customer's demand as the average of several months' reading of the indicator instead of the highest reading obtained. This is the method adopted in the power contracts of the Boston Edison Co. where the customer's annual maximum demand is taken as the average of the monthly readings of his demand indicator for the months of October, November, December and January. It should be noted, where the demand is taken as the highest reading of the indicator for the year or as the average reading of several months, that in the case of a new customer the demand must be estimated until the proper readings can be taken.

In all that has been said above it has been assumed that the customer's demand was his demand for the year and that each month's bill was therefore made out on the basis of the same demand. Where, however, a contract for a year is not made, but a reading is taken from month to month, it is the practice of some companies to base the demand charge on the monthly maximum. This makes a simple system, as the estimate above mentioned does not have to be made, and the customer's bill is determined wholly by the monthly readings of his demand indicator and watt-hour meter.

Some companies combine the measured demand with the estimated demand. Instead of installing a demand indicator on all their customers except the smallest (generally a company cannot afford to assume the maximum demand of its smallest customers as anything less than the connected load) a company will use the indicators to check doubtful estimates, or as a means of detecting a dishonest customer. With this method the indicator is not necessarily permanently installed, but may be moved about from one customer to another.

4. *Demand Limited.*

Still another practice is to determine the maximum demand by agreement with the customer and then to make it impossible for him to exceed this demand. As it would not be expedient to use any means of limiting the customer's demand, which would actually cut off his service, the limiting is usually done by means of a device which will cause his lights to flicker the moment the agreed upon demand is exceeded.

This practice, as compared with the measured demand, has the advantage of positively determining the demand in advance, and it avoids the indicator readings necessary with the measured demand. It has the disadvantage of causing irritation when a customer on an occasion wishes to exceed his demand and finds he cannot do so. The owner of a large residence would probably strongly resent any interference with the use of such lights as he might at any time turn on and it would nevertheless be difficult to make him agree to a demand very much higher than what he usually expected to have. On the other hand, it may be said that many small customers would prefer to have their demand fixed and thus be prevented from inadvertently exceeding it and thereby raising their bills. It would seem that a judicious use of both the measured demand and the limited demand methods of charging might be found advantageous.

	Connected load.	Demand estimated.	Demand measured.	Demand limited.
Advantages—		Fair basis of charge.	same	same
	No instrument.	same.		
	Demand fixed in advance.	same.		same
			Notifications not necessary.	same.
			Inspections unnecessary.	same.
			Accurate determination.	same.
			Large connected load not discouraged.	same.
Disadvantages—				
	Unfair basis of charge.			
			Instrument necessary.	same.
			Demand not fixed in advance.	
	Notifications necessary.	same.		
	Inspections necessary.	same.		
	Inaccurate determination.	same.		
	Large connected load discouraged.	same.		

In closing there is given above a summary of the advantages and disadvantages of the different methods of determining demand.

Spark Gaps.

By JAMES FOSTER KING.

TO secure the best efficiency from a spark gap in a space telegraph transmitter, the designer is confronted with a paradoxical proposition whose component parts, when analyzed by themselves and then collectively, are characterized by the imposition of at least two widely differing physical conditions.

In order to enhance the difference between these two conditions, namely, the unenergized non-conductive state and the energized or finally highly conductive state—it has been found necessary to apply boundary conditions whose gradient is both steep and short.

In the application of a potential difference to the metallic boundaries of a circuital discontinuity, there is first a transition of the impressed energy residing on the boundaries to the surrounding medium in the form of an electro-static charge.

The surface temperature rise produced by the heat developed in this transition and the temperature of volatilization of the metal terminal determines the stability of the terminal structure. There can be no highly conductive spark from a positively charged terminal until this critical temperature is reached and a structural instability is established.

For an impressed potential difference, the charge that is radiated from the positive terminal is proportional to the potential, the specific inductive capacity of the surrounding medium, and inversely as the separation of the bounding surfaces of the system. The heat developed is proportional to the square of the current of charge, and the resistance, which in turn is a function of the separation and assumed sectional area through which this charge is appreciably felt.

As the heat developed in the transition depends principally on the current of charge, it is impossible to increase indefinitely the length of gap (even though the impressed potential difference may be greatly increased thereby) and develop the charge necessary to volatilize the positive terminal surface, and still conform with the general resistance imposition after the spark is fully developed.*

There are many ways open to the designer to increase the current of charge in the transition by modifying either the structural conformation of adjacent terminal surfaces from two elementary points to parallel plates of any suitable area, or the specific inductive capacity of the surrounding medium or both.

To render the energy transfer through the gap most sudden, the time-period of the transition should be inappreciably longer. This period depends on many factors, the principal one being the time required in raising the sparking surface above the critical temperature of the metal from its initial surface temperature. The actual temperature of the terminal depends on the present force and the previous temperature condition of the surface.

The temperature rise necessary to produce volatilization with liquid terminals is small, while that necessary to volatilize solid terminals is comparatively great. To secure short periods of transition with terminals of metals having high critical temperatures, the current of charge must be large. Any visible indication of discharge during the period of transition is termed the brush or corona.

Where the terminal surfaces approach one another, the current density of charge is increased, and the temperature developed is relatively greater. Such point or points form the base upon which a highly conductive vapor filament is developed and projected through the path of least resistance to the oppositely charged terminal surface. Usually this filament is initially of infinitely small diameter, which becomes greatly enlarged after it has effected a junction with the negative boundary; which junction determines the collapse of the previously existing static field. This collapse of the static field liberates a large quantity of kinetic energy in the form of a current increment which, added to the normal flow, so increases the temperature and amount of vapor in the arc as to materially increase its volume.

The free chemical dissociation, *i.e.*, the indefinite diametrical enlargement of an arc of terminal vapor of any particular gradient for heat capacity is limited by the rate of heat absorption by the surrounding medium. If this heat absorption is constant, the ratio of expansion of terminal vapor for different temperatures is constant. Consequently, the diameter of the spark depends on the heat absorption, the heat capacity gradient and the current.

As most metallic vapors combine with oxygen, the effects of a heterogeneous mixture with their oxides have to be considered when determining the specific resistance of a spark for its various temperatures. The relative electrical conductivities of a pure metallic vapor and a heterogeneous mixture of that vapor with its oxide differ inappreciably for the high temperature of incandescence attained during the maximum of current flow in a spark, although the specific heat capacity of this oxide may be infinitely less than its parent metal at ordinary temperatures. The resistance effect of the oxides become most apparent when the vapor is condensing.

After the current flow through the arc has reached a maximum and the impressed exciting force is reduced to zero, this arc undergoes a period of decline which results in its ultimate extinction. The length of the period of extinction depends primarily on the rate of vapor condensation allowed by the existing current flow.

If the surrounding medium will support oxidation, the periphery of the vapor column will alone become oxidized. All effects must therefore be transmitted through this layer by external influences.

During the decrease of heat developed in the interior of the spark, this fictive layer of oxide will be first exposed to the cooling effect of the surrounding medium, and will consequently first contract and alter in electrical conductivity.

At temperatures below incandescence, the specific heat capacity of a cooling metallic vapor column becomes greater and the heat stored in individual ions is increased.

Under the force of contraction due to the collapsing oxide boundary the free ions are gradually forced into contact with one another solidifying the structure and equalizing the temperature en masse. Owing to the comparatively greater heat capacity of the solid terminals, these free viscous particles adhere to them in the form of minute though visible burrs. The metallic ions, remaining free, are carried away with the oxides in the form of an infinitesimal powder by convection currents, set up by temperature differences in the surrounding medium, leaving the gap free from conducting ions.

The foregoing may be considered a history of conditions existing in the spark gap and is divided according to logical sequence into the developments of the spark from an initially non-conductive through a highly conductive to a declining state.

Where the character of energy transfer through the gap is oscillatory as in the case of a closed circuit oscillator including an inertia coil, a spark gap and reflecting condenser there are two sparks during a complete period of oscillation, either terminal being alternating positively charged.

Where there is a succession of sparks controlling appreciable amounts of energy, the initial temperature of the spark terminal surfaces mentioned before will rise considerably higher after the first spark has passed than the actual temperature before the first transition.

Some Approximations of the B. & S. Gauge and of the Properties of Copper Wire.

By C. P. NACHOD.

THE Brown & Sharp or American gauge of wire diameters is a geometrical series having .4600 = No. 0000 wire for the first term, and .005 = No. 36 as the fortieth term, the series being extended, however, to No. 40 wire, the forty-fourth term. The relationship is, therefore,

$$.4600\, r^{39} = .005,$$

whence r is found to be .89053.

Denoting the gauge number of the wire by n, the sizes 0, 00, 000, 0000 having the values 0, —1, —2, —3, respectively, the equation for the diameters is

$$d = .46 \times .89053^{n+3}.$$

For the circular mils area, the ratio being the square of that for the diameter, the equation is

$$cm = .46^2 \times 1000^2 \times .89053^{2(n+3)} = 211{,}600 \times .79305^{n+3} \quad (a)$$

These equations when evaluated will give results corresponding exactly with the tables; but it is easily seen that they are not convenient for reconstructing the table quickly in the absence of it. By making $r^3 = \frac{1}{2}$ (it being more exactly .49873) a great simplification results; and it is then evident that for every numerical increase of six sizes the diameter is halved, and that for every in-

*See ELECTRICAL WORLD AND ENGINEER, April 15, 1905, page 719, formula (5).

crease of three sizes the sectional area is halved. This approximation involves—assuming the respective series are identical at the No. 40 end—a total departure of 3.6 per cent at the other end, less than the table.

This approximation may be expressed in various equations, which may be conveniently evaluated for every third size, all involving the same total error, but varying in the distribution of it. Among the simplest of these are:

$$cm = 2^{\frac{50-n}{3}} \qquad (b)$$

$$cm = 10 \times 2^{\frac{40-n}{3}} \qquad (c)$$

$$cm = 25 \times 2^{12-\frac{n}{3}} \qquad (d)$$

$$cm = \frac{2^{20-\frac{n}{3}}}{10} \qquad (e)$$

Equation (*b*) coincides with the table at No. 17, which is near its middle, whereby the error at the ends is divided. It will give integral exponents for any size one less than a multiple of three. Equation (c) coincides with the table between No. 25 and No. 28, and gives integral exponents for any size one greater than a multiple of three. Equation (*d*) coincides at No. 36 and equation (*e*) between No. 6 and No. 9. They both give integral exponents for sizes that are multiples of three.

Any one of these equations is sufficient to cover all sizes by approximating the ratio as .8 for the next larger or smaller size, and dividing or multiplying by this as the case may be.

It is well to remember also a few of the higher powers of 2, as $2^{12} = 4096$, $2^6 = 64$; by which the equation can be easily handled.

An inspection of the table shows that for each numerical increase of ten sizes the cross-section is approximately divided by ten.

From the circular mils the other properties can be very quickly gotten, as follows:

Dia. in mils $= \sqrt{cm}$

$$\text{Weight per thousand feet} = \frac{cm}{330}$$

$$\text{Resistance per thousand feet} = \frac{10400}{cm} \text{ at about } 70^\circ \text{ F.}$$

Mercury-Vapor Lightning Arresters and Circuit Breakers.

Five patents were issued September 12 to Mr. Peter Cooper Hewitt for apparatus using mercury vapor as a conductor of electric current. One of the patents relates to lightning arresters, while the others deal with circuit-breakers.

Fig. 1 shows the circuits of the arresters, the operation of which depends upon the quality of mercury vapor of possessing a high initial electrical resistance which can be overcome by a sufficiently high potential. The apparatus is deranged to resist the normal potential of the line, but will permit current to pass when the potential reaches a certain higher voltage. Should an excessive potential be impressed upon the main conductors by a lightning charge, when it reaches the predetermined limit, it will traverse the vapor apparatus and will be dissipated through a discharge or a succession of discharges through the apparatus to earth. When used on alternating-current circuits, as soon as a lightning discharge shall have overcome the normal resistance of the apparatus, the current will be immediately cut off at the first alternation, since the negative electrode resistance immediately re-establishes itself unless the flow is continued in the original direction. Accordingly the line current will not follow the lightning discharge to earth and the circuit will not be grounded. When the apparatus is applied to direct-current circuits, the same effect of cutting off the flow of current will be brought about by the fact that the particular apparatus applied to the circuit is so designed as to develop too much heat under the influence of the normal current in the circuit to permit the current to flow.

One form of circuit-breaker is illustrated in Fig. 2. The vapor apparatus is here shown in shunt to a switch. The junction of the apparatus is to prevent excessive sparking or an injurious rise of voltage in the circuit when the switch is opened. The apparatus is provided with two starting bands, one near each electrode, which are connected to the secondary terminals of a transformer. By this arrangement of devices the vapor apparatus, which is short-circuited when the switch is closed, will, when the switch is opened,

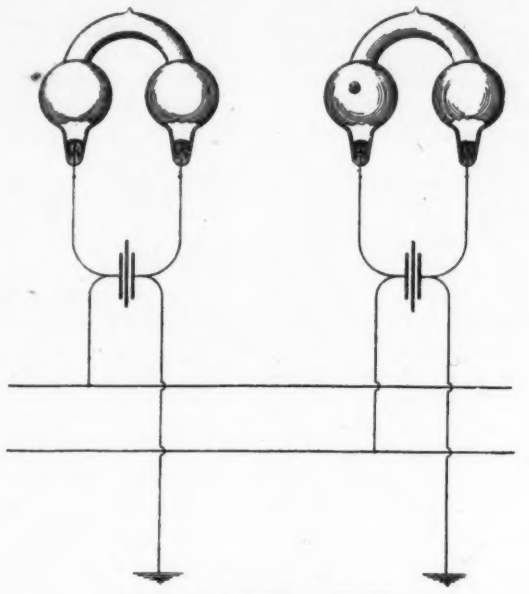


FIG. 1.—LIGHTNING ARRESTER.

have impressed upon it not only the full voltage of the current at the electrodes, but also a secondary voltage at the starting bands. These combined effects are sufficient to start the vapor apparatus and permit a temporary flow of current through it, thus relieving the sparking at the terminal of the switch. Any

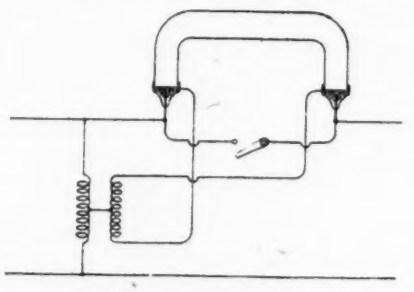


FIG. 2.—CIRCUIT-BREAKER.

tendency to maintain an alternate flow of current through the vapor device will, however, be defeated by the development of too great density of vapor in the apparatus, which is designed in this instant for suppressing the flow after the first passage of current has performed its function of relieving the hand switch. In a modified form of circuit-breaker, the rupture of the circuit within the

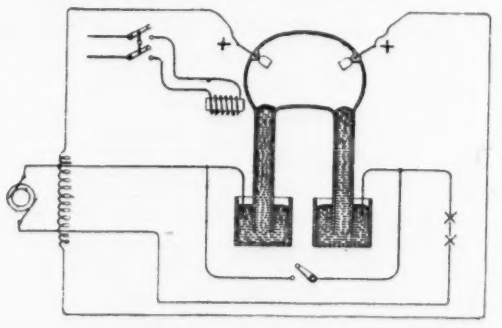


FIG. 3.—VAPOR SWITCH WITH MAGNETIC BLOW-OUT.

vapor apparatus takes place through the action of a magnet upon the current passing through the gas. The effect of the magnet is to deflect the current passing through the apparatus which is so designed as to allow the deflection to be sufficiently great to interrupt the current. The circuits are indicated in Fig. 3, where two supplemental electrodes perform the function of starting bands.

New Telephone Patents.

CORDLESS SWITCHBOARD.

The fact that the cords of a manual exchange switchboard are one of the most vulnerable parts with respect to necessary wear and tear, has led to many attempts, all more or less crude, to obviate their use. We have at hand for consideration a cordless switchboard, the invention of J. L. Wright, of Cleveland, Ohio. In this switchboard there are arranged behind a face plate a set of contact plates. For each jack aperture there is a sliding jack which, while maintaining contact with its line, is adapted to connect with any pair of contact plates, according to the distance it is pushed back from the face plate. The plugs are made in assorted lengths and assembled in pairs by thongs of leather or fibre. As each plug of a pair is shoved home, the jack of the line is pushed back into contact with the corresponding connecting plate.

LOCK-OUT COMMON BATTERY SYSTEM.

A lock-out for common battery party line systems has been patented by M. P. Boone, of Peru, Ind. This requires at each station a high inductance relay, bridged from the grounded side of the line to ground. The armature of this, if the coil be energized, swings as a latch to block the hook switch springs. If the two limbs of a line be bridged together at any station there arises a difference of potential between the ground and the grounded side of the line to operate the lock of all stations save the one which made the bridge.

ANTI-HUM.

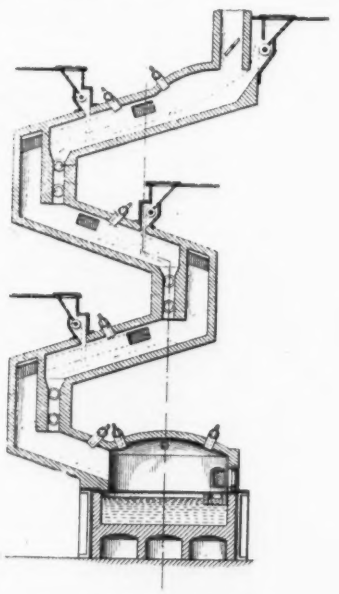
B. P. Bartlett, of Norway, Kan., has patented an anti-hum device for insertion in service wires which hum disagreeably. It consists of a double dead-ending insulator with a central longitudinal hole through which the insulated tie wire, connecting around the lead ends, is led.

Recent Electrochemical Developments.

ELECTRIC FURNACE PROCESSES.

A patent recently granted to W. von Bolton for purifying tantalum metal in the electric furnace is interesting since it covers the method which, according to the latest reports, is now used for the manufacture of the pure tantalum required for the filaments of the new tantalum lamp. The use of electric heat is necessary, since a very high temperature is required.

The process of purification of tantalum from impurities, especially from tantalum oxide, is based on the fact that the oxide is volatilized



BENJAMIN FURNACE.

sooner than the tantalum metal itself. The process is carried out in a vacuum, since at the high temperature employed the tantalum metal reacts with nearly all known elements.

A patent recently granted to E. Stassano refers to details of construction of a revolving electric arc furnace. The furnace chamber revolves around an axle inclined to the vertical. This furnace is the same which, according to the report of the Canadian Commission, is now used in the Government Gun Foundry in Turin, Italy, for steel refining. According to this report the furnace consists of a cylindrical outer casing of iron surmounted by a conical roof; it is lined with magnesia brick. The axis of the furnace about which it rotates during the operation includes an angle of 7° with the vertical. Three-phase currents at 90 volts between the phases and 400 amp. are supplied through three electrodes which nearly meet in the center of the furnace. Their distance apart is varied by a hydraulic regulator.

G. H. Benjamin has recently patented a furnace which appears to be mainly intended to be used for glass manufacture. The chief feature is that fluxes with lime are introduced into the sand at successive points in its line of travel from the place where it is charged into the furnace until it reaches the tank of the furnace. The furnace is so designed that the light materials in the form of fluxes are not subjected at the time of their introduction into the furnace to the carrying action of flames or air currents on their way to the exit flux from the furnace. The accompanying illustration shows the construction. The circular tank is at the bottom. Extending from one side of the tank and in an upward direction is a flue in form of a series of communicating inclined and vertical passages. All vertical passages are divided into two compartments, the outer ones forming by-paths for the products of combustion which flow to the chimney flue, while the inner compartments form the connection between two succeeding inclined passages. These inner compartments contain the electrodes for the arcs. The sand falls downward through the arcs. Just before the sand reaches such a vertical passage fluxes are introduced through specially provided hoppers as shown in the illustration.

LETTERS TO THE EDITORS.

The Use of the Third Person in A. I. E. E. Discussions.

To the Editors of Electrical World and Engineer:

SIRS:—Will you permit me—one of the persons instrumental in bringing about the change—to add a word to your reply to Mr. Behrend's letter in your issue of September 9, regarding the use of the third person in the reports of the discussions before the American Institute of Electrical Engineers?

Your comments on Mr. Behrend's letter cover the matter practically conclusively, but I think you could have dwelt more strongly on the one claim that Mr. Behrend makes for the use of the first person—that is, "individuality." So far from preserving the "individuality" of the speakers, I believe it to be highly desirable to suppress it as much as possible; the discussions are designed to preserve technical information, and not to exploit a mass of ill-digested opinions, expressed in ungrammatical and slovenly language, which constitutes almost invariably the only "individuality" of the manuscript of the discussions. It was my duty, as chairman of the Editing Committee, to look over a large mass of this stuff (for there is no other word for it), and the more I read of it the more firmly I was convinced that ninety per cent of it should be suppressed, and I did suppress as much as I possibly could, against strenuous opposition in many cases. As far as I can remember, there is but one member of the Institute whose extemporaneous remarks are fit for printing, as taken down by the stenographer.

Mr. Behrend's specific criticisms are well enough, but they prove simply that the editing in this case, and doubtless in many others, was not well done. The Institute is not able to pay a sufficient force to do this work properly, and a large amount of clerical work was thrown on the Editing Committee, and in consequence did not receive the attention it deserved. I believe that no one acting on the Editing Committee can fail to come to the same conclusion—that is, that the bulk of the discussion should be suppressed, and the remainder of it carefully edited and put in the third person, thus making it as innocuous as possible.

NEW YORK. CARY T. HUTCHINSON.

Alternating-Current Nomenclature.

To the Editors of Electrical World and Engineer:

SIRS:—The point brought up by Mr. Woodbridge in regard to alternating-current nomenclature is an important one, since the

difference he mentions has given rise to considerable confusion. The difficulty originated not so much in the conception of a vector rotating in a clockwise direction, instead of counter-clockwise, as in the use by Dr. Steinmetz of polar co-ordinates, i. e., in the representation of instantaneous e.m.f's or currents by the length intercepted on a revolving line by a fixed circle instead of by the projection of a revolving line on a fixed vertical line.

This point came up for discussion at a meeting of the A. I. E. E., the subject being introduced by Dr. Kennelly, who complained that it was necessary to stand on one's head in order to understand Dr. Steinmetz's reactances (*Trans.* A. I. E. E., Vol. XVIII, p. 82). Dr. Steinmetz in this discussion stated his reasons for the use of counter-clockwise rotation. The subject is also discussed, in the A. I. E. E. *Transactions,* Vol. XXI, p. 589, by Prof. Franklin, who is strongly in favor of the counter-clockwise method.

The fact is that up to the time Dr. Steinmetz brought out the symbolic or complex imaginary method of dealing with alternating-current problems, the universal custom, in this country at least, was to use counter-clockwise rotation as exemplified in Bedell and Crehore's "Alternating Currents" and other text-books. Dr. Steinmetz claims that the polar diagram is simpler and less artificial than the one commonly used, but, as stated by Mr. Woodbridge, counter-clockwise rotation is taken as positive in trigonometry and analytical geometry, and if a student who has been taught this is plunged into the study of a text-book where positive rotation is taken in the opposite direction, the whole subject is made unnecessarily confusing. In the book on "Alternating Currents," written by Prof. Franklin and the undersigned, counter-clockwise rotation is assumed throughout, and in cases where the symbolic method is introduced, the signs are changed as suggested by Mr. Woodbridge, the expression $r + jx$ being used for impedance.

Cincinnati, Ohio. R. B. Williamson.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Locating Short Circuits Between Armature Coils.—Gilliam.—A description of a device for locating short circuits between armature coils without disconnecting the windings. As shown in Fig. 1, it

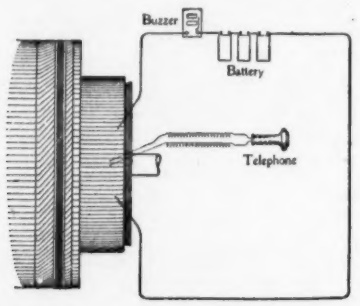


FIG. 1.—DIAGRAM OF CONNECTIONS.

consists of three dry cells, a buzzer for interrupting the current and a telephone receiver. A short circuit can readily be located by passing the interrupted current from this apparatus through the winding, and then moving the leads from the receiver from bar to bar on the commutator. If there is a short circuit between the bars of the commutator or winding, there will be no audible vibration in the receiver. If, on the other hand, the winding and commutator are clear of short circuit at the point tested it will be indicated by a distinct vibration or buzzing. In the case where an alternating-circuit of 200 or 100 volts is at hand a more convenient method of finding a short circuit is to attach the leads of this circuit to almost any part of the commutator of the armature to be tested. Then the same method as before can be followed with the result that the vibration is much more distinct than in the former case, and the ceasing of these vibrations can be more easily marked—*Elec. Journal,* September.

Evolution of Electric Machines.—Tischendoerfer.—An illustrated lecture held before the Berlin Elec. Soc. The author sketched the development of the construction of electrical machines and gave a concise summary of modern practice in the design of direct-current and alternating-current generators and motors. He then gave the principal steps of development in the predetermination of electric machines, giving formulas as well as some empirical constants. The concluding part of the paper deals with the construction of turbo-generators and unipolar dynamos.—*Elek. Zeit.,* Aug. 24.

Lights and Lighting.

Temperature of the Arc and of the Sun.—Weidner and Burgess.—An account of an experimental investigation. The photometric methods based on the extrapolation of Wien's equation show that the "black body temperature of the arc" (pure graphite) is at least 3,750 deg. abs, so that its true temperature must be higher than this; it is not possible to state how much, in the absence of more definite knowledge concerning the departure of carbon from black body radiation. In the light of the best evidence that is at present available it would seem that the true temperature of the hottest part of the positive carbon is between 3,900 and 4,000 deg. abs. There is a most satisfactory agreement between the results of the different laws of the radiation at these high temperatures. If it is assumed that the Wien-Planck and the Stefan-Boltzmann relations continue to hold good for thermodynamic radiation at these high temperatures, it would seem that the phenomena of luminescence play no very important part in the radiation from the positive pole of the electric arc; for, if so, it might be expected to lead to higher values in the estimates based on the photometric methods than would be found by methods dependent on total radiation. An examination of the available estimates of the temperature of the sun, made by methods based on the photometric intensity, seems to indicate that these methods lead to higher values than those based on the energy of total radiation. Thus, using the former method, Le Chatelier finds 7,900 deg. abs. The estimates, based on total radiation and on the position of the wave length of maximum energy in the solar spectrum, lead to values in the neighborhood of 5,500 deg. to 6,000 deg. absolute. If this difference in the methods really exists it would at least suggest the presence of luminescent radiation. —*Bull. Bureau of Standards,* No. 1.

Lighting of Schools.—Mueller.—An account of experiments on the lighting of school rooms. At the outset a rule is laid down that the strength of the illumination at all points in the room should be at least 2.04 candle-feet. The first experiments were carried out in a room 25 ft. 3 in. x 23 ft. wide x 13 ft. 3 in. high. It was stripped of all furniture and fittings and the walls and ceiling were given a fresh coat of lime wash. The source of artificial light consisted of four groups of tantalum lamps with matte globes, each group containing six lamps of 22 candlepower arranged under a reflector of mirror glass at a height of from 8 to 9 ft. above desk level. This system of direct lighting was found to give a sufficiently bright and uniform light for a room of the size in question, even when allowance was made for the gradual soiling of the walls and ceiling, and the diminution in illuminating power of the lamps themselves. The illumination at writing level is not likely to fall below the 2 candle-feet required. The next series of experiments were carried out upon indirect lighting by means of arc lamps. The room used was 34 ft. long x 24 ft. 3 in. wide, freshly washed as in the former case. Two school lamps for indirect lighting were employed slung approximately from the longer diameter of the hall about 8 ft. from either end wall, i. e., about 18 feet apart. The lamps required 10.4 amperes and absorbed 1,144 watts. They were fitted with metallic reflectors, which threw all the light upwards on to the ceiling and on to a strip about 4 ft. wide at the upper part of the walls. The direct incandescent tantalum lamps which gave an illumination at working level equal on the average to 4.1 candle-feet in the first schoolroom when empty, gave an average equal to 2.85 candle-feet when the room was fully occupied with benches and scholars; i. e., it suffered a loss of about 30 per cent. The indirect arc light employed in the second hall gave a strength of illumination equal on the average to 3 candle-feet in the empty room, which fell to 2 candle-feet when the room was filled. This loss was equal to about 33 per cent. Shadows were distinctly noticeable under the direct light, but were almost entirely absent from the

indirect illumination. Using tantalum lamps consuming about 2 watts per candle, the power used in the two cases was about the same.—Lond. *Elec. Rev.*, Aug. 25.

Utilizing Arc Carbon Wastes.—BERNARD.—A note stating that at the electric station in Brixen, in Tyrol, the wastes of arc carbons are pasted together and used again. Two such pieces of carbon are properly cut off and covered at the surfaces to be joined with a paste of water glass and powdered carbon and then put together with slight pressure. It is stated that an ordinary workingman does this work. Carbons thus joined together are said to be as good as new carbons whether used with direct-current or alternating-current. The resistance is not very different from that of new carbons.—*Elek. Zeit.*, Aug. 31.

Mean Spherical and Mean Horizontal Candle-Power.—FLEMING.—A mathematical paper with reference to a recent experimental investigation of Dyke on the ratio between the mean spherical and the mean horizontal candle-power of incandescent electric lamps. The author reaches the conclusion that the performance of a lamp is sufficiently well indicated by the mean horizontal candle-power taken when rotating the lamp about its vertical axis. If this reading is taken at such a distance from the lamp that the whole filament does not subtend a greater angle than 5 deg. to 10 deg. at the photometer-disk, then the mean spherical candle-power of the incandescent lamp is for practical purposes very nearly obtained by multiplying this mean horizontal candle-power by the factor $\pi/4$. From the measurement of the electric power in watts supplied to the lamp, we have at once the means of calculating the total flux of light per watt which fixes scientifically the efficiency of the lamp as an energy-transforming device.—*Phil. Mag.*, August.

Car Lighting.—TWEEDY.—Hints as to how to proceed in considering a system of car lighting. The following points should be considered: (1) The number of lamps and the candle-power of each to give the most effective distribution with the least possible intensity above a certain fixed limit: (2) the best possible distribution of the lamp: (3) the shape and finish of the roof, with special reference to the diminution of deep returns, heavy mouldings and rough surfaces. Not only will the simplest form of roof and decorations be the best for economical lighting; it will also be easier to keep clean and to maintain generally.—Lond. *Elec. Rev.*, Aug. 25.

Metallic Arc.—LADOFF.—A continuation of his summary of various investigations on the electrochemistry of the metallic arc.—*Electrochem. and Met. Ind.*, September.

POWER.

Cost of Energy for Power in a Small Engineering Works.—Some notes on the actual cost of energy used in driving a small engineering works. The various classes of tools are grouped together so as to be driven off line shafts as short as possible, and all are driven by means of cross belts and countershafts in the usual way, except two hoists and a ventilating fan which have each a separate motor. The motors are mostly of fairly low speed, and they drive the line shafts direct without the intervention of countershafts for speed reduction. There are in the whole eleven motors used in the smith's shop, pattern shop, tool room, etc. The total capacity of these eleven motors is 82 horsepower, but the average horsepower used is only between 10 and 11 on account of intermittent running of the majority of the motors. The current is obtained at a charge of 3 cents per kw-hour for the first 1,500 kw-hours, afterward 2 cents per kw-hour; accounts are payable quarterly and 5 per cent discount is allowed. Accounts are given for the last three-quarters and show that in the average the cost per kw-hour was 2.158 cents.—Lond. *Elec. Rev.*, Sept. 1.

Power Plant Design.—KOESTER.—In a continuation of his profusely illustrated serial on modern power plant design and economics he discusses coal and ash handling machinery, boilers, stokers, smoke consumers and draft, the purification of the boiler feed water, the advantages of superheated steam (which he believes are not generally recognized in this country) and steam pipes and covering.—*Eng'ing Mag.*, September 4.

Scotch Power Plant.—An illustrated article on the opening of the first generating station of the Fife Electric Power Company, which will supply power in bulk to an extended area. The first station is situated at Townhill and contains two steam driven 400-kw alternators, giving two-phase currents at 50 cycles at 3,000 volts. This is only a "pilot station." The intention is to erect later an entirely separate new plant on a much larger scale with bigger units and so arranged as to lend itself to expansion up to 60,000-kw capacity. The proposed transmission voltage is 11,000.—Lond. *Elec. Rev.*, Aug. 25.

British Power Company.—The first part of an illustrated article on the Yorkshire Electric Power Company's system of generation and distribution. There will be four generating stations, of which one has just been completed at Thornhill. One prominent feature is the reduction of capital expenditure to a minimum. "In a general sense, the station is built on the separate-unit system, which is now recognized as correct practice for large undertakings." The main generating units at present installed consist of two 2,000-kw Curtis turbo-generators. They are of the 4-stage type and run at 1,000 r.p.m.—Lond. *Elec.* Sept. 1.

High-Voltage Power Transmission.—FOWLER.—An article treating in a general way the subject of high-voltage power transmission. The selection of the line voltage, the arrangement of line conductors, high-tension insulators, and pole lines are considered.—*Amer. Elec.*, September.

Automatic Boiler Feed Pump.—SCHMIDT.—A short illustrated article in which the author calls attention to the merits of the centrifugal pump for boiler feeding, and points out that such an application would confer the benefit of automatic feed to a higher degree and with simpler auxiliary apparatus than would be possible with reciprocating pumps.—*Amer. Elec.*, September.

TRACTION.

Single-Phase Car Control.—JACKSON.—Experience has shown that in single-phase traction the fine gradation of voltage given by the induction regulator is not required for ordinary operating conditions. The author describes the very simple control worked out by the Westinghouse Company. The standard voltage on the trolley is 3,300. This voltage is reduced on the car by means of a transformer of the single-winding for auto-transformer type, one end of which is grounded in order to use the rails as return circuit. The simplest control is obtained by connecting the motors between ground and the desired points of the transformer winding. The required voltage points are brought out from the winding by means of taps. With such a method of control the motors may all be placed permanently in multiple and any series-parallel arrangement becomes a useless complication. In order to step from one tap to the next without opening the circuit or short-circuiting the winding on the transformer between the taps it is necessary to employ a preventive coil to take up the intervening momentary voltage. The drum type of controller is generally used on equipments up to and including four 75-hp motors when multiple unit control is not required. Externally, this controller resembles the ordinary direct-current type. There are, however, no magnetic blow-outs or series-parallel connections. For all ordinary purposes, five points of control are employed and give a smoother acceleration than is usually obtained with direct-current motors. Fig. 2 shows the connection of the auto-transformer for different positions of the controller. On larger cars where multiple operation of several cars from one master controller is required, the control is obtained by means of switches operated by compressed air and of general design similar to the switches used in direct-current multiple control. The method of operation is substantially the same as that used in the drum controller. A magnetic blow-out is necessary for the proper operation of the switches. The method of control applicable to heavy locomotive work is also described. Fig. 3 is a diagram of wiring on a car equipped with two single-phase motors. It has been found in practice that alternating current up to 500 or 600 volts is much

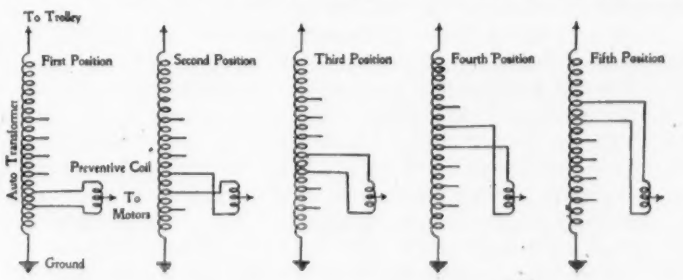


FIG. 2.—SINGLE-PHASE CAR CONTROL.

easier to break than direct-current of the same voltage. There is, moreover, no such tendency to flash to ground or to short-circuit and to maintain an arc over long distances as is manifested by direct-current. With alternating-current, however, switches must be

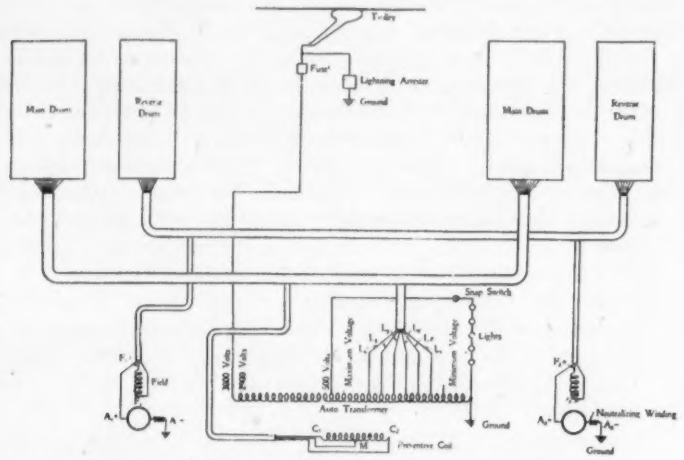


FIG. 3.—TWO-MOTOR SINGLE-PHASE CAR CONTROL.

so designed as to provide against excessive generation or concentration of heat due to hysteresis and eddy currents. In an editorial note Storer remarks: "Altogether the prospects of the single-phase railway system are wonderfully bright. At least six lines are in daily commercial operation in this country. The troubles incident to the use of an entirely new type of apparatus are being rapidly eliminated and success is assured."—*Elec. Jour.*, September.

High-Speed Electric Traction.—A very extensive resumé of the tests made during the first year of the Berlin-Zossen high-speed experiments, giving especially full data on the subject of train resistance and braking at speeds up to 100 miles per hour, with accompanying charts.—*St. R'y Jour.*, Sept. 9.

Retardation Tests.—SAKUNO TANABE.—A note giving the results of retardation tests with an unloaded covered railway wagon. The equation $R = 2 + 0.4\ V + 0.04\ V^2$ gives in this special case a close approximation to the observed relationship between R, the resistance in pounds per ton of 2,000 pounds, and V the velocity of the vehicle in miles per hour. The last term of the equation, namely, $0.04\ V^2$, is nearly equal to the resistance of the atmosphere, leaving the former two as the rolling resistance only of the vehicle.—*Memoirs College Sc. & Eng.*, Kyoto Univ., v. I, No. 2.

Measuring Speed of Locomotives.—An illustrated description of the application of the Frahm speed measuring device for use on locomotives. The principle was described in the Digest April 29. A small alternating-current generator is placed on one running axle of the locomotive and supplies alternating-current of a frequency proportional to the speed. The frequency is measured by means of a comb with a series of teeth tuned to different frequencies as was formerly described.—*Elek. Bahnen.*, Aug. 14.

Electric Plant for Fixing Rails and Packing Permanent Way Construction.—An illustrated description of a portable plant used on some French railways for permanent way construction and repair. The various tools are electrically driven, the current being generated by a steam-driven dynamo. Direct-current at 220 volts is used. The whole generating set weighs but 3.3 tons net. It can be carried by road or rail and contains a pair of main wheels, made with a wide flat rim, for transport on common roads, and at each corner a pair of small flanged wheels for running on railway lines. Current is connected and supplied to the machine tools by small trolleys. —Lond. *Eng'ing*, Aug. 11.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Electrical Equipment of Manufacturing Plant.—BURNHAM.—An illustrated description of the hydro-electric plant of the Willimantic Mills of the American Thread Company. Although contrary to modern practice, the generating units instead of being grouped in one central station are spread out through the various mills, and in each case, driven from the main shaft or the water turbines. There are three dams built across the Willimantic River for impounding the water. The available horse-power of the first is 950 for ten months in the year and 350 for twelve months. The available horse-power at the second is 300 horse-power for twelve months in the year and about 250 horse-power for ten months. The average total available water power is about 1,100 horse-power yearly. The total power consumed is about 3,000 horse-power, of which 1,100 is derived from water and the remainder is furnished by steam-driven units.—*Amer. Elec.*, September.

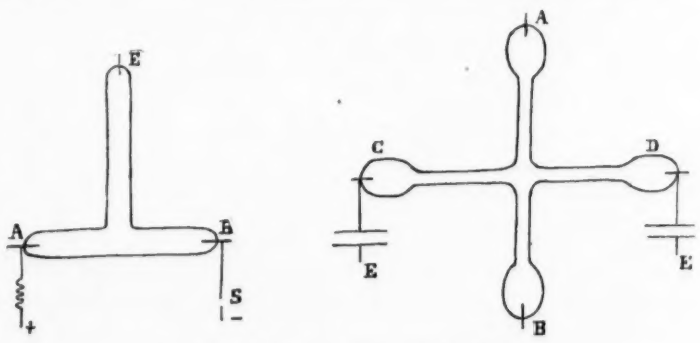
British Central Station.—An illustrated description of the electric plant of Frome-Selwood. The equipment comprises three steam turbo dynamos, two of which have a capacity of 150 kilowatts each, and the third 75 kilowatts. Consumers have the choice of two tariffs. The price per unit on the maximum demand system is 14 cents and 8 cents per kw-hour for lighting and power, respectively, for the first hour and for any further kw-hour 6 cents for lighting and 2 cents for power, or a flat rate of 12 cents for lighting and 5 cents for power.—Lond. *Elec.*, Aug. 18.

Accumulators with Reversible Boosters for Factory Installations. —BIRKETT.—An article giving data from actual practice to show that the installation of a battery coupled with an automatic reversible booster in a factory installation is most satisfactory in taking care of a very variable load so that current for lighting and power may be taken from the same generators and the same system of mains although the fluctuation of load is very large on account of starting and stopping of current motors, etc. The usefulness of a battery for emergency cases of special requirements is also pointed out.—Lond. *Elec. Rev.*, Aug. 25, Sept. 1.

ELECTROPHYSICS AND MAGNETISM.

Radium and Uranium in Minerals.—RUTHERFORD AND BOLTWOOD.—It has been shown by extended experiments that within the limit of experimental error the amount of radium present in radioactive minerals, is proportional to the content of uranium. The quantity of radium associated with one gram of uranium in a radioactive mineral is equal to approximately 7.4×10^{-7} gram. One part of radium is, therefore in radioactive equilibrium with approximately 1,350,000 parts of uranium. By the application of these numbers to the ordinary ores of uranium it is possible to determine their actual content of radium. Thus a high-grade pitch-blende ore containing 60 per cent of uranium carries approximately 0.40 gram of radium, equivalent to 0.69 gram of radium bromide, per ton of 2,000 pounds. A low-grade 10 per cent uranium ore will contain per ton approximately 0.067 gram of radium, equivalent to 115 milligrams of radium bromide.—*Am. Jour. of Science*, July.

Side Discharge of Electricity, Comparison of Condensers.—TROWBRIDGE.—An account of observations which he has made with the installation of a large storage battery of 10,000 to 20,000 cells. Experiments were made with Geissler tubes, as shown in Fig. 4.



FIGS. 4 AND 5.—SIDE DISCHARGES.

The terminal A is connected permanently with the pole of the battery through a large water resistance (several megohms). The terminal, B, is connected to the negative pole by a spark gap, S. E is connected to the earth. At the instant the spark occurs a brilliant side discharge occurs between E and B. If the negative pole of the battery is permanently connected through the large water resistance to B, and A connected by a spark-gap to the positive pole of the battery, the side discharge takes place between E and A. At the same time that these side discharges take place, a discharge passes between A and B. It is evident that the capacity of the region outside the battery, the room, and building charges up under the difference of potential between it and the poles of the battery, a difference of potential which is greater than that between A and B, which are connected by the small resistance of the rarified gas. This phenomenon suggests a photometric method of comparing the capacity of large condensers and also of obtaining the

capacity of the immediately surrounding space. Fig. 5 represents a modification of the tube represented in Fig. 4. To the arm *C* and *D* of the cross are attached the condensers which are to be compared. At the instant of the completion of the circuit with the storage battery under the conditions mentioned above, two side discharges take place from *C* and *D* either to *A* or *B*. By bringing the light of these two simultaneous discharges into a suitable photometric arrangement, one can compare the capacity of the condensers, to the degree of accuracy obtainable by ordinary photometric determinations. Since it is difficult to obtain an estimate of the capacity of large bodies of irregular shape and of large extent, this method may be of use. By a suitable vacuum tube and proper exhaustion the method does not require a large number of cells.—*Am. Jour. of Science,* July.

Discharge Potentials.—BOUTY.—An account of experiments in which he found that the critical field beyond which a gas gives way to an electric charge is the sum of two terms. One of these is characteristic of the gas and independent of the temperature when the mass and volume are kept constant. It greatly preponderates at pressures above a few tenths of a millimeter of mercury. The other term, which only comes into force at very low pressure, depends essentially upon the dielectric substance of the wall and upon any gaseous layer which may be adhering to it. When the second term is negligible, the possible difference of potential between two electrodes may be written $= a \vee pe\ (pe + k)$, where a is the dielectric cohesion of the gas, p its pressure, e its thickness and k a constant varying with the gas. For the same gas, this difference of potential only depends upon the product of pressure into thickness, or, in other words, upon the quantity of gas affected by the discharge. In the case of large masses, the discharge potential depends upon a constant quantity amounting to about 1,760 volts for air, and upon another term amounting to 2.46×10^{7} volts per gram of air traversed per square centimeter. At high altitudes the possible field would become so small that the air cannot even support the earth's electric field without giving way.—Lond. *Elec.,* Aug. 18; from *Comptes Rendus,* July 31.

ELECTROCHEMISTRY AND BATTERIES.

Action of Acids on Iron.—BURGESS.—The first part of a paper on the action of acids on iron and the use of the acid pickle. The author discusses the general importance of the problem and present practice in acid pickles. The paper is to be concluded.—*Electrochem. and Met. Ind.,* Sept.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electrical Units.—WOLFF.—A discussion of the "so-called international electrical units" giving the different resolutions and definitions adopted by various congresses and in different countries, together with a critical discussion of the whole situation.—*Bull. Bureau of Standards,* No. 1.

Silver Voltameter.—GUTHE.—A full discussion of the silver voltameter and the precautions which must be taken in its use. The electrochemical equivalent of silver is given as 1.11683 mg per coulomb.—*Bull. Bureau of Standards,* No. 1.

Optical Pyrometry.—WEIDNER AND BURGESS.—A very useful summary of the principal methods of determining high temperatures by optical means. "There is an impression current that an optical pyrometer is of necessity a very delicate, mysterious piece of laboratory apparatus, not fitted for shop practice, and not to be trusted except in the hands of an expert, and even then giving results of uncertain reliability; but one of the primary objects of this paper is to show that there are several trustworthy optical pyrometers available, simple in operation, and suited to the most varied and exacting requirements of scientific laboratories and technical works." After a general discussion of optical pyrometry the authors give a concise summary of the laws of radiation. The total radiation is given by the Stefan-Boltzmann law, which states that the total energy radiated by a "black" body is proportional to the fourth power of the absolute temperature. The black body, according to Kirchhoff's definition, is one which would absorb all radiations falling on it and would neither reflect or transmit any. Bodies which depart from black body radiation, emit less total energy than black bodies. The greatest departure from black body radiation is found with polished platinum. The displacement law of Wien states that as the temperature of the radiating source is changed the wave length having the maximum energy in the spectrum will be changed in such a way that the product of this wave length to the corresponding absolute temperature of the source of radiation is equal to a constant; i. e., if the temperature rises the maximum of energy shifts toward shorter wave lengths. Laws concerning the distribution of energy in the spectrum of a radiating body have been given by Wien and Planck. "The remarkable agreement of the Planck equation with the results of experiment throughout the extreme ranges in which it has been tested at least justifies the hope that it is something more than a purely empirical relation, which may some day earn the title of a "law of nature." The authors then discuss the methods of optical pyrometry which make use of one or the other of the above laws of radiation. "In practice a standard of intensity is chosen, and the brightness of the photometric field illuminated by the red light emitted by the body under observation is varied until it is equal in intensity to that of the standard either by use of an iris diaphragm (Le Chatelier), an absorbing wedge (Fery), or by a polarizing device (Wanner), or the standard light may itself be varied according to some known or empirical relation (Holborn-Kurlbaum, Morse)." The various commercial optical pyrometers are described and discussed in detail. In the conclusion of the paper the authors discuss some special problems in optical pyrometry and especially departure from black body radiation. The authors conclude that apparently the several laws of radiation are in quite satisfactory agreement at the highest attainable temperatures (about 3,700 deg. C.) and thus serve to define the same scale of temperatures.—*Bull. Bureau of Standards,* No. 2.

Adjustable Condenser.—SWAYNE.—An article with dimensional drawings on the construction of an adjustable condenser suitable for high-potential currents, especially wireless telegraphy, where it is said to be superior to either Leyden jars or glass plates.—*Amer. Elec.,* Sept.

Factory Testing of Electrical Machinery.—WORKMAN.—In a continuation of his long serial, illustrated by diagrams, he deals with induction motors and describes how to find the power factor for any current and how to determine the primary copper loss, the iron and friction and windage loss, and the secondary copper loss.—*Elec. Jour.,* September.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—PREECE.—A paper read before the (Brit.) Assoc. Advanc. Sc. giving first a summary of the development of wireless telegraphy in Great Britain and elsewhere by private parties, companies and official departments. The author then briefly discusses the fundamental points of the sending station which are the source of energy, the transformer, the antenna and the air and ether; and the fundamental points of the receiving station, namely, the antenna, receiver and the earth. He reaches the following conclusions: "Wireless telegraphy is really still in its experimental stage. Great progress has been made and will continue. The sea is its domain. Here it is practical and even commercial, but not reliable for continuous periods or for long distances. It has not yet been proved effective over land, excepting for comparatively short distances where the earth is moist and rivers abound. There are very few places where it can compete financially with telegraphs and telephone, and it would be folly to apply it for telegraphic purposes where simple wires can be erected and telegraphs and telephones employed. It is not even cheap, for though the capital expenditure is smaller, the working expenses are greater and the speed of working less. "An engineering system that utilizes only one billionth of the energy it generates is scarcely practical economics, though it may, for vital purposes, be of inestimable value. For war purposes wireless telegraphy is imperative whatever its cost."—Lond. *Elec.,* Sept. 1.

Earth Connection in Wireless Telegraphy.—EVANS.—An illustrated note on some experiments with Hertz oscillators. In the course of experiments in wireless telegraphy for military purposes it became important to determine the effects produced by different methods of earth connection of the aerials. For this purpose an oscillator was used, as shown in Fig. 6, consisting of a square capacity, area (17 ft. by 17 ft.) suspended horizontally by insulators 14 ft. above the ground. From the center of this area a vertical wire led to one knob of a spark-gap, the other knob being connected by a similar wire to an arrangement of iron wire netting (17 ft. by 17 ft.) placed directly below the upper area and suspended horizontally by insulators 2 ft. above the ground. The current flowing

in the vertical wire was measured, and the lower capacity area (the wire netting) was then connected to the ground by short wires allowed to rest on the earth's surface, and the current in the vertical wire again measured. A third modification was made connecting the lower capacity area to a good telegraph "earth" when a third current reading was taken. It was found that the current flowing in the vertical wire in the first case was reduced by 56 per cent when the lower capacity area was allowed to touch the

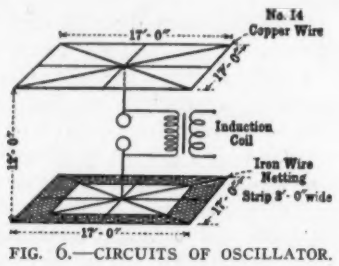


FIG. 6.—CIRCUITS OF OSCILLATOR.

ground, and by 85 per cent when the lower capacity area was connected to the telegraph earth. The distance between the two areas, the wave length, etc., were kept constant in all these tests, and the figures given above are the means of a considerable number of observations. By means of a receiving station carefully syntonized and of similar design to that of the transmitter, about 1,000 yds. distant from the transmitter, variations in the amounts of the received currents were observed closely comparable to the variations of the current in the transmitter for the three tests mentioned above. The conclusions arrived at were that any connection of the transmitter or receiver with earth was objectionable.—Lond. *Elec.*, Sept. 1.

MISCELLANEOUS.

Meter.—FISCHER.—An account of a recomparison of the United States prototype meter No. 27 with the standards of the International Bureau of Weights and Measures in Paris.—*Bull. Bureau of Standards*, No. 1.

Monophone.—COURTOIS.—An illustrated description of the monophone which combines in one apparatus the telephone receiver and transmitter as shown in Fig. 7, which is almost self-explanatory. The microphone consists of two diaphragms, *C, C;* in the hollow space between them carbon grains are placed.—*La Revue Elec.*, June 15.

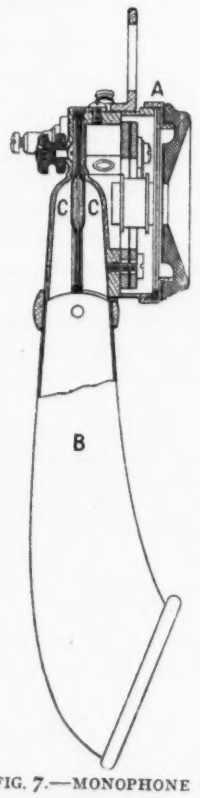


FIG. 7.—MONOPHONE

Electric Rgeulation of Temperature in Incubators.—A note on an electric regulator for incubators which is being used in Victoria, Australia, and consists principally of a thermometer and an electrically operated relay. As long as the temperature in the incubator remains below 103° F.—which is the proper temperature of incubation—the gas or other lamps supplying the heat are full on. When 103° F. is reached, the mercury in the thermometer completes an electric circuit, the relay is actuated, and either turns down the flame or deflects the heat supply. As soon as the temperature falls below 103° F. the circuit is broken, and the full heat is again supplied to the incubator. Current is obtained from one Leclanche cell.— Lond. *Elec.*, Sept. 1.

The South Wales Coal Field.—A note on a detail map on a large scale which has been prepared by Mr. G. E. Gordon, mining engineer, of Swansea, showing the collieries, works, etc., in the South Wales coalfield. Besides giving full particulars under these heads, the map indicates the railways and stations, canals, and the class of coal obtained. There are also diagrams showing the average prices of the last decade and the annual output since 1860. The work, which is admirably executed, shows the various centres clearly, and should be of decided value to engineers for reference. Incidentally, the numerous dots illustrative of the mines and works exemplify what an extensive and, at the same time, compact area the South Wales Power Company have to work upon for the supply of energy for industrial purposes.—Lond. *Elec. Eng.*, Sept. 1.

BOOK REVIEW.

THE CHICAGO TRANSPORTATION PROBLEM. By Bion J. Arnold. New York: McGraw Publishing Company. Two volumes, 310 pages, 15 folded plates and 14 large maps. Price, $5.00.

This work is a reprint of the report of Mr. B. J. Arnold to the Committee on Local Transportation of the Chicago City Council on the Chicago urban transportation problem. Originally, only a very limited edition was issued for the use of the officials of the City of Chicago. The object of the present edition is to supply a demand for the report as a general engineering treatise on the broad problems of street railway construction, operation and management in a large city. The text is divided into six parts, as follows:

Part I is a general discussion of street railway systems and the conditions governing them. Large cities are divided into three classes and the earning capacity per mile in each class is discussed. Part II treats of the present situation in Chicago and recommends certain improvements. Part III forms a study of population and traffic. This is a most interesting part and contains much valuable data concerning the great cities of the world. Curves are plotted for each city and a general law deduced. A very exhaustive analysis has been made of the traffic in Chicago, and the data are given in such a way as to be valuable to those who may be studying the same problems in any other city. In this part tables are given showing the itemized cost of maintenance and operation of electric and cable roads and the capitalization of the various Chicago companies. Part IV discusses the relative merits of operating cars over through routes as compared with downtown terminals and the question of transfers and fares. Part V forms a discussion of a new reorganized and unified system of street railways for Chicago, with an estimate of the gross receipts from all sources.

Part VI is divided into nine chapters and forms the major portion of the book. This part will be found of great engineering value. Chapter I describes plans for a high-level and a low-level subway. The method of construction is clearly shown by eleven folded plates. In making these subways disposition has been made of all public utilities, such as water mains, gas mains, sewers, telephone, telegraph and power cables. Chapter II concerns the underground electric conduit system. Chapter III treats of electrolysis. Chapter IV contains suggestions concerning the improvement of traffic conditions on the existing elevated lines. Chapter V forms a valuable discussion of track rails and track construction in large cities. It contains many cuts showing track construction and rail profiles used in the several large cities of the United States. Chapter VI contains unit price estimates, i. e., the itemized cost of producing complete one mile of track using ten different types of construction. Chapter VII contains itemized valuation estimates of the entire equipment of the various railway companies operating in Chicago. These include estimates on the cost of track, paving and trolley construction, power stations, rolling stock and real estate. These cost estimates are supplemented by an analysis of the depreciation. Chapter VIII contains data similar to that in the preceding chapter, except that the valuation estimates are made on certain grants which expired at a date earlier than July, 1903. Chapter IX deals with the most interesting part, namely, the cost estimate of the construction and operation of the proposed subway and surface lines.

The nine chapters are supplemented by an appendix which contains data concerning all the Chicago street railway lines. The report is contained in two volumes. The first volume is alphabetically indexed, contains 310 pages of text, 50 cuts and 15 folding plates. The second volume contains 14 folding plates, each 18 inches by 33 inches.

New Westinghouse Railway Motor.

The accompanying illustrations refer to a new line of motors for heavy traction now being introduced by the Westinghouse Electric & Mfg. Co. The smallest motor of the new design is rated at 75 horsepower, and the largest at 200 horsepower, there being a number of intermediate sizes.

Among the features of particular interest which characterize these motors may be mentioned the diagonally divided field frame which makes every part accessible; the gear case supported entirely at the ends, so as to avoid the side strains which have been the source of so much trouble; housings for armature bearings clamped between the

two halves of the frame; generously proportioned bearings with a system of lubrication claimed to be the most effective yet devised; armature and commutator assembled upon a single spider; bar-wound armature with split coils; commutators with many bars; low-current density in the brushes; bolted-in laminated poles; sealed field coils wound with strap; excellent commutation; high efficiency; low operating temperature and great mechanical strength.

Limitations are naturally placed on the size and construction of a motor by the amount of available space on the truck of the car; therefore, the frame of square cross-section was adopted as utilizing

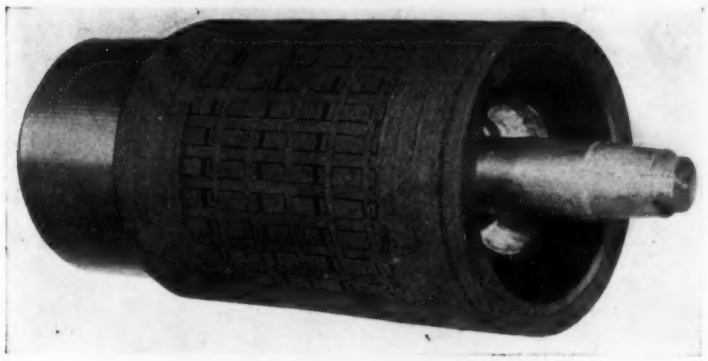


FIG. 1.—ARMATURE.

this space most advantageously. All motors in this line have cast steel frames split at an angle of 45 deg. with the horizontal. The axle bearings are carried by the lower half of the field frame and are divided at an angle of 35° with the perpendicular, so that the weight of the motor is supported almost entirely by the part of the frame extending over the axle rather than by the axle cap bolts. By lifting off the upper half of the field casting the armature may be removed from the frame without taking the motor from the truck; or the motor may be removed from the truck by simply taking off the gear case and axle caps. Three bales, conveniently located, make handling of the motor easy. Bolts with nuts and lock washers hold the two halves of the frame together and the axle caps in proper position.

Housings for the armature bearings are circular in form and are turned slightly larger in diameter than their seats in the frames so that when clamped in place, all the advantages of a press fit are obtained. Finished shoulders on the housings prevent any lateral movement and also take the entire end thrust of the armature instead of imposing this severe strain on the clamping bolts. Two bolts through the frame at each end prevent the housing from turning.

The armature bearings are made of solid phosphor-bronze bushings finished all over, with a 3/32-in. lining of babbitt metal. If from neglect the bearing should become so hot as to melt the babbitt the armature would be supported on the brass shell and would not

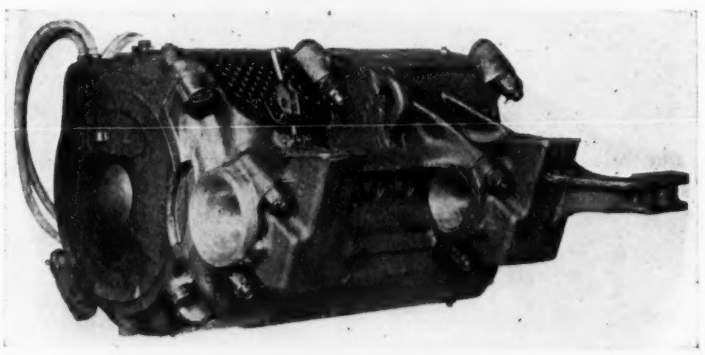


FIG. 2.—VIEW OF MOTOR, SHOWING AXLE BEARINGS.

strike the poles. Both oil and waste lubrication are provided. The waste comes in contact with the bearings on the low pressure side and is supplied with oil from separate pockets from below; in this way it is filtered before reaching the bearing. The amount of oil in the reservoirs may be gauged so that it may be kept at the proper level for economical service. It is stated that with intelligent care these bearings will run 100,000 to 150,000 miles.

The axle bearings are similar in construction to those of the commutator, except that split bushings are used. Here also lubrication is by means of oil and waste, the oil being supplied from below. This is the same method which has given such universal satisfaction in steam railway service. All bearings have generous dimensions, and the large surfaces readily dissipate the frictional heat and insure cool running.

The laminated pole pieces are bolted to the top, bottom and sides of the motor frame, which, being almost square in cross section, permits the use of flat field coils. These coils are wound of copper

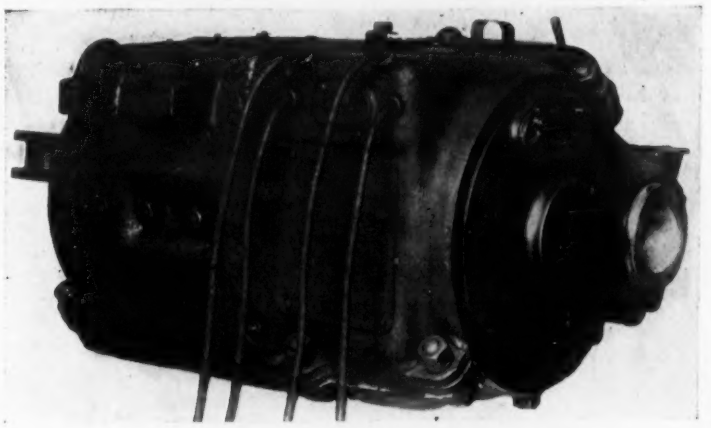


FIG. 3.—EXTERIOR OF MOTOR.

strap insulated between turns with treated asbestos ribbon and then carefully taped and given repeated dippings in specially prepared insulating compounds and varnishes which make them moisture-repelling and able to stand internal heat. Brass hangers hold the coils in place independently of the poles.

The shaft is forced into the finished armature and keyed thereto and may be removed, should necessity arise, without disturbing the windings or commutator. The armature coils are strap wound and made in two parts. As the top coils are more liable to injury this design makes it possible to remove the damaged part without disturbing any other part of the winding. The coils are liberally

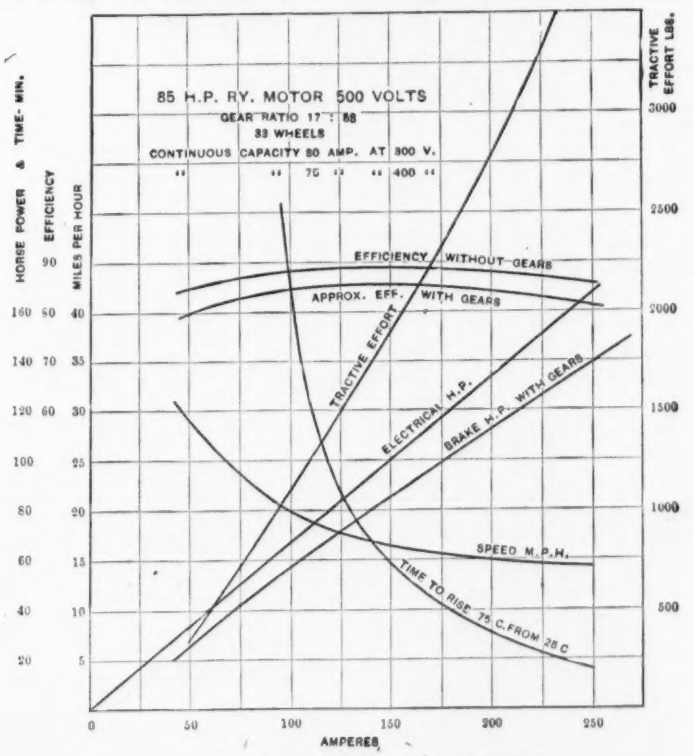


FIG. 4.—CHARACTERISTICS OF 85-HP MOTOR.

insulated with mica, and sealed and further insulated by dipping in varnishes which are oil-proof and moisture-repelling. On each end the armature slots are made deeper and wider, thereby providing space for mica cells, which greatly reinforce the insulation at these points. As a further protection fibre strips are taped to the upper sides of the top coils. A bell-shaped flange at the pinion end and a cylindrical flange on the commutator end form rigid supports for the windings. Countersunk bands of steel wire on the core hold the coils firm and secure. Openings through the spider and core

allow a free passage of air, which is thrown forcibly against the field coils, thus maintaining a low temperature throughout the motor. The design of the motor windings, the great number of bars in the commutators, and the even wearing qualities of the insulation produce commutating characteristics of the highest merit.

The brush holders are of the sliding type with springs of phosphor-bronze held in a harness which definitely fixes the radius of action of the spring tip, and is so constructed as to practically eliminate friction between turns, making it possible to provide a large number of turns, which gives a very uniform pressure upon the brush over a considerable range without requiring adjustment. The tension of the spring may be adjusted without removing the holder from the motor. The brush holder proper is bolted to an insulated guide and may be removed without disturbing the insulation or connections. Leads of flame-proof flexible rubber-covered cable

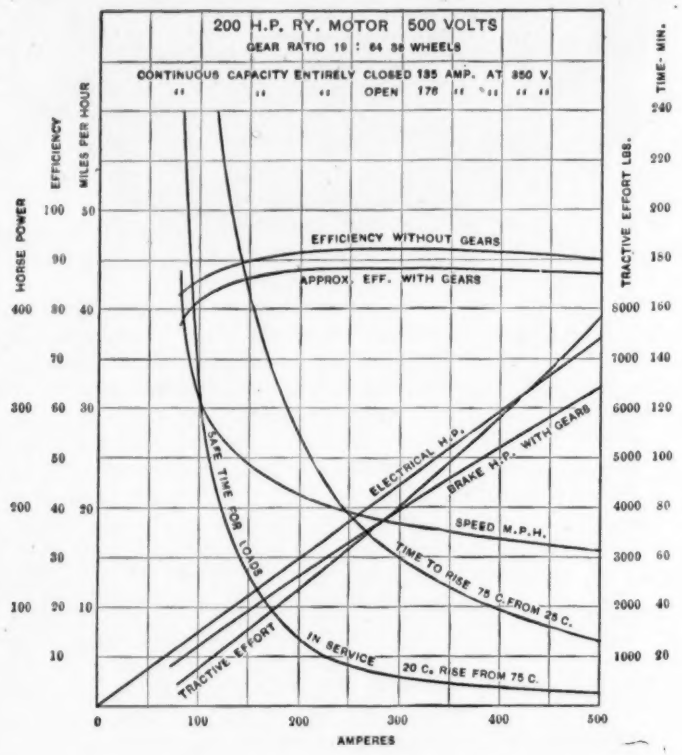

200 H.P. RY. MOTOR 500 VOLTS
GEAR RATIO 19 : 64 36 WHEELS
CONTINUOUS CAPACITY ENTIRELY CLOSED 135 AMP. AT 350 V.
" " " OPEN 176 " " " "
HORSE POWER
EFFICIENCY
MILES PER HOUR
TRACTIVE EFFORT LBS.
TIME - MIN.
EFFICIENCY WITHOUT GEARS
APPROX. EFF. WITH GEARS
ELECTRICAL H.P.
BRAKE H.P. WITH GEARS
SPEED M.P.H.
TIME TO RISE 75 C. FROM 25 C.
SAFE TIME FOR 1 OAD
TRACTIVE EFFORT
IN SERVICE
20 C. RISE FROM 75 C.
AMPERES

FIG. 5.—CHARACTERISTICS OF 200-HP MOTOR.

are brought out at the front of the motor over the commutator through insulating bushings. Access to the brushes and brush holders is provided through a large opening in the frame over the commutator which extends well down the side, making inspection easy from the pit. A hole in the rear end bell and an opening under the commutator provide means for inspecting the clearance between the armature and field poles.

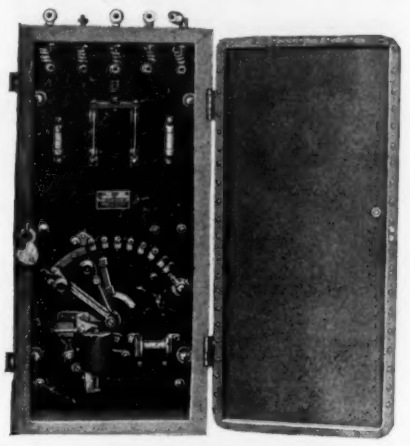
Pinions used on these motors are machined from solid steel forgings and held on tapered seats by keys, nuts and lock washers. Gear cases are made of malleable iron and divided along the center line of armature and axle. They are supported only at the ends, which does away with all side strains which are responsible for so many broken gear cases. Nose suspension with safety lugs is used for all motors of this design.

Machine Tool Controller.

The accompanying illustration shows an armature speed controller possessing numerous advantageous characteristics which render it especially well suited for use for machine or similar duty. The method of mounting and insulating the resistance is such that the result of a burn-out would be practically the same as would occur with an entirely enclosed resistance. All the motor-starting stationary contacts are of the segment form. The movable contacts of the speed-controlling lever are of the self-adjusting type, and are able to ride over any projection standing 1/16 in. above the contact segments. To prevent arcing upon the circuit-closing contacts, there is used an independent, spring-operated, renewable, circuit-closing switch, which breaks the circuit with a quick break.

The no-voltage release protective device is responsive solely to the line voltage, and is entirely independent of the field current or the armature current. The overload protective device is an independent interlocking automatic circuit-breaker, which automatically opens the entire circuit whenever, from any cause or under any conditions, a current in excess of that for which the circuit-breaker is adjusted is passed through the rheostat and motor.

There is but one lever carrying current both for starting the



MACHINE TOOL CONTROLLER.

motor and regulating the speed of the motor. The rheostat starting and speed controlling lever cannot be left on any of the starting contacts, but can be left continuously on any of the field resistance contacts.

This controller is being placed upon the market by the Ward Leonard Electric Company, Bronxville, N. Y.

Steel Frame Motors.

The accompanying illustration shows the constructional features of a line of steel frame motors which have been designed with a view to supplying the demand for a strong, light machine of high efficiency and good wearing qualities; a machine capable of with-

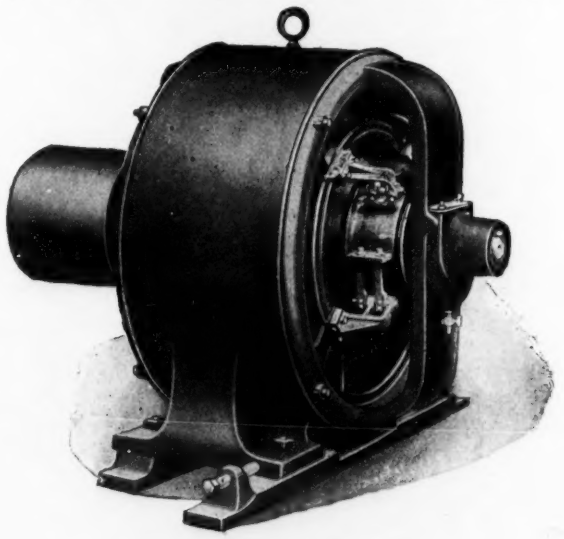


FIG. 1.—STEEL FRAME MOTOR.

standing heavy overloads and sudden fluctuations of load, universal in its application and with all parts readily accessible.

The frame is built of close grained steel, making a much smaller and more compact machine to give the same output, than would be possible with cast iron. The brackets are centered against the crown and firmly held by steel bolts; but can readily be removed to allow easy access to fields and armature. (See Fig. 2.) The poles are also of steel and equipped with a special design of laminated tip or shoe, to provide the necessary magnetic fringe, which eliminates sparking at the brushes, produces cool running, and heightens the efficiency of the machine. The bearings are made of a specially prepared bearing metal, and are of the self-

oiling and self-aligning type. They are made to standard gauge and reamed, so as to be interchangeable and easily replaced. Oil wells of ample capacity are provided in each pedestal.

The brush holders are of a simple, yet thoroughly effective design. The brushes are of the best quality of carbon, and are rigidly attached to the holder, the proper adjustment being secured by a tension spring. Sparkless operation of the brushes, wearing and heating of the commutator, freedom from noise, and good commutation are to a great extend dependent upon the design of the brush holder, and the design of the Triumph brush holders is all that can be desired in these directions.

The entire brush rigging is carried from the front end of the crown, as shown in Fig. 3, so that no oil can reach the brush

FIG. 2.—VIEW OF POLES.

holders and cause a short-circuit. All the brush holders are convenient of access, and the yoke, when properly set, is held in that position by a lock screw.

During the construction all parts are submitted to a series of thorough inspection and tests, the tests for insulation being made

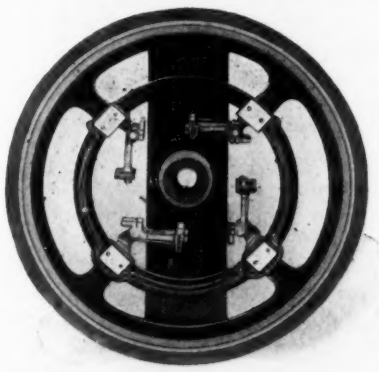


FIG. 3.—FRONT BRACKET AND BRUSH RIGGING.

with 1,500 volts alternating e.m.f. Before shipment each machine is given a complete running test, under full load, for sufficient time to bring it up to its maximum temperature, so that every machine is known to be correct when it leaves the factory.

The motors are being placed upon the market by the Triumph Electric Company, Cincinnati, O.

Battery Volt-Ammeter.

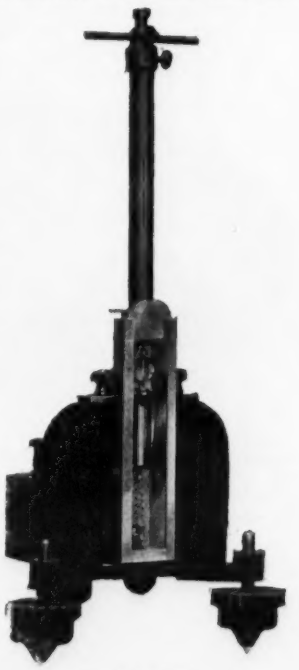
Whenever batteries of any description are employed it is extremely desirable to have at hand some means to test their qualities. If even one of the cells is worn out the efficiency of the others is lowered, and when these cells are used to supply current for telephone transmitters, difficulty in making one's self heard is the result. The Connecticut Telephone & Electric Company, of Meriden, Conn., has placed upon the market a new type of volt-ammeter, shown in Figs. 1 and 2, which is especially designed for testing batteries. It is made up in two styles, one as a combination volt-ammeter and the other reading amperes only. The scales are graduated from 0 to 30 amp. and from 0 to 6 volts, and are very carefully calibrated. The arrangement of the needle supports permits very delicate and accurate reading. This instrument can be used without the cord

FIGS. 1 AND 2.—VOLT-AMMETER.

shown in Fig. 1 by holding it in the hand, as shown in Fig. 2. The instrument is guaranteed by the company to be both accurate and durable.

Galvanometer for Cable Testing.

The Leeds & Northrup Company, of Philadelphia, has recently placed upon the market a new form of high sensibility D'Arsonval galvanometer for cable testing, shown in the accompanying illustration. In design it is a radical departure from the old style laminated magnet with suspension tube that allowed but small clearance for the coil and did not permit the suspended system to be visible. This improved design possesses the following prominent features:



GALVANOMETER.

The removal of the tube containing the moving system is readily effected by the loosening of two thumb-screws. If any adjustments are to be made, such as the insertion of a new suspension, the tube can be removed from the magnet and laid horizontally on a table, which is often of great convenience. The tube has at its back a simple device for clamping the coil, so that the galvanometer and tube may be moved about. The coil suspension has a spring device in the top of the tube so that the suspension is not easily broken.

The entire system is visible by means of the open glass front given to the tube. A small index point on the coil shows when the galvanometer is exactly level and the coil is swinging centrally in the field. The coil is of the rectangular type and made as small and light as possible in order to give the greatest sensibility with a given period of swing. To provide the highest possible insulation the entire galvanometer is insulated from earth by means of three hard rubber leveling screws terminating in steel points. The bottoms of the leveling screws have deep grooves turned in them, thus making a "petticoat" insulation.

Alternating-Current Rectifier.

An interesting form of alternating-current rectifier is shown in the accompanying illustration. While the operation of the device depends upon the opening and closing of a circuit at the desired instants according to the relative signs of the alternating e.m.f., no synchronous motor with revolving commutator or equivalent equipment is employed. The position of a vibratory contact maker is determined by the polarity of an electromagnet whose coil is subjected to the alternating e.m.f.

The contact maker, which is mechanically connected to the polarized armature of a permanent magnet, is normally held closed. During operation, the polarized armature is acted upon not only by the permanent magnet but also by the electromagnet. When the polarities of these two magnets are of the same sign, the contacts are held tightly together. When, however, the electromagnet reverses its sign and becomes of sufficient strength, the polarized armature is repelled, and the circuit broken. Thus the circuit is closed when the e.m.f. is of one sign, and is open during the major portion of the time when the e.m.f. is of the opposite sign, so

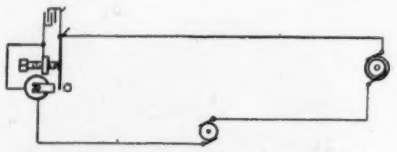


DIAGRAM OF CIRCUITS OF RECTIFIER.

that the resultant current, although pulsating in value, is practically unidirectional.

It is evident that a combination of two rectifiers with relatively reversed electromagnets will allow equal values of currents to be taken from the source of supply both when the e.m.f. is negative and when it is positive so that the load on the supply system will be balanced with reference to the successive alternations.

The device is simple, of few parts and quite compact. For charging the storage batteries of automobiles at places where only alternating current is available, the magnetic rectifier possesses the advantageous feature of being transportable by the automobile itself. This rectifier is the invention of Mr. J. Hart Robertson.

Automatic Measuring and Mixing Machine.

Where materials are to be fed to kilns or furnaces, the intermittent introduction of cold materials from weighing machines,

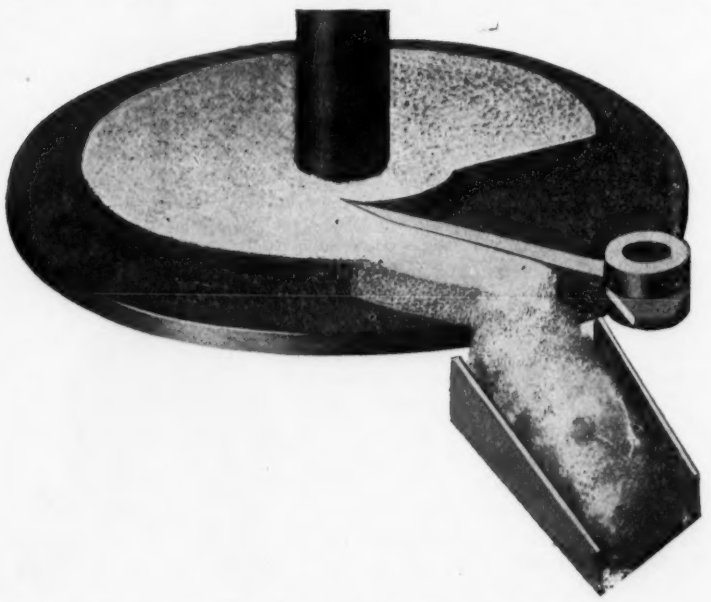


FIG. 1.—MECHANISM FOR INSURING REGULARITY OF DISCHARGE.

or even a continuous, but slightly irregular, feed may cause a deterioration of the product, and in any event cuts down the capacity of the apparatus, sometimes as much as 50 per cent., besides injuring the furnace itself. To meet the urgent need of such apparatus in the works of The Solvay Process Company, Mr. E. N. Trump, chief engineer of that company devised a continuous measuring machine, which is adapted to feed one substance or to proportion the several ingredients of a mixture. More than a dozen of these machines were made for this company, and were used in their different plants for such varying purposes as the feeding of kilns, the mixture of chemicals, the manufacture of

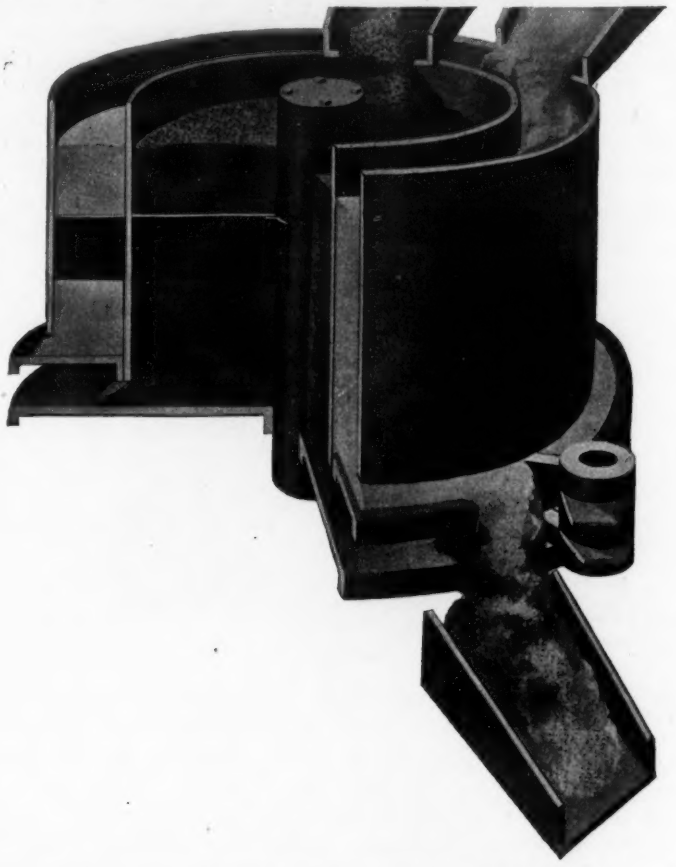


FIG. 2.—SECTIONAL VIEW OF MEASURING AND MIXING MACHINE.

coke briquettes, feeding of rocks, the making of concrete, etc., and handled material of 6-in. cube dimensions to the finest of powders—both wet and dry. In actual service-test they were so successful that they are now being marketed by the Link-Belt Engineering Company, Philadelphia.

The Trump measuring machine consists essentially of a horizontal revolving table, on which the material to be measured rests, and a stationary knife set just above the table and pivoted on a vertical shaft just outside the circumference. This knife can be adjusted to as to extend the proper distance into the material on the table, at each revolution of which it peels off a certain amount, which falls over the table edge into the chute. This is shown in Fig. 1. The amount of swing of the knife is controlled by a screw attached to an arm, cast as part of the knife, and a micrometer scale with pointer shows the amount of movement.

Where it is desired to measure off and mix two or more materials, the machines are made with two or more tables, set one above the other, and mounted on the same spindle so that they revolve together, each table having its own storage cylinder above it, and the cylinders being placed one within the other as shown in Fig. 2. For each table there is a knife, with its own adjusting mechanism, which allows the user to vary, at will, the percentage of each material in a mixture; and, as the materials flow together constantly and regularly in small streams as they drop down the common chute, each infinitesimal amount of one ingredient is accompanied by the proper amounts of the other ingredients, and the particles become intimately mixed.

In feeding materials to the storage cylinders of these machines a conveyor is necessary merely to see that enough is kept in the storage cylinders so that the amount which the knives peel off will be constant. With some finely powdered materials, which flow very freely, it is necessary to place feeding-seals at the top of the storage cylinders to regulate the density and pressure on the material below, so that it will not pack or flow out at the bottom too rapidly and flood the table.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Business in general is in a very satisfactory condition, and nothing occurred during the week to diminish the existing widespread confidence. There is a disposition to extend plans further into the future, and many plants have their facilities engaged well into next year. As demand broadens there is a natural tendency to enlarge capacity, which adds to the already exceptional structural activity. Jobbers have secured much more forward business than at this date last year, especially in dry goods lines, and the frequent reminders of autumn temperature stimulate retail distribution of wearing apparel. Gratifying reports are made as to crops, and everything points to an unprecedented yield of corn. Several settlements maintain labor disputes at the minimum, and mercantile collections continue prompt. The railways are doing a large business despite the unusually light grain movement, due to the reluctance of farmers to sell their products at current prices. The gross earnings for August were 5 per cent in excess of those of the same month last year, when the present wave of activity first manifested itself, marking a continuing progressive gain for that month in every year since 1896. Reports from Chicago state that the present fall trade has never been equaled and that rail mills and car builders have a year's business booked. Chicago jobbers report business 10 to 15 per cent in excess of their best previous year. In the Northwest the farmers are very busy, and retail trade is still quiet, but will improve as soon as the spring wheat moves to market. Business in all sections, except in the South, where it is somewhat affected by the yellow fever quarantines, is large, and even in the South in some lines it is at the highest level. The business failures for the week as reported by *Bradstreet's,* numbered 188, as against 137 during the week previous and 167 the corresponding week last year. The largest consumers of copper seem to be well supplied for current needs, while the smaller ones are apparently waiting for lower prices. The market was unsettled and slightly lower, Lake and electrolytic being quoted at 16c. and casting stock at 15¾c.

COPPER PRODUCTION.—In a report by Charles Kirchhoff, of the Division of Mines and Minerals, on the copper industry of the world, the following interesting facts are given regarding the same: A comparatively high level of prices, an enormous production and an unprecedented export demand were the characteristic features of the copper trade in 1904. The industry has been exceptionally prosperous and has displayed an activity which promises a further notable addition to production during the year 1905. Undertakings begun in 1904 will only bear fruit in 1905, and some developments will not add to output until well into 1906. Improvements in mining, concentrating and smelting are making available to an increasing extent very extensive bodies of low grade ores, and are rendering the copper industry less dependent upon the discovery and the life of individual rich deposits. The development and operation of low grade properties, however, calls for relatively very large capital investments. The unit of maximum efficiency of plants is growing and tends to an increasing concentration of interests. Broadly, the features were an increase in the production of copper in the United States of 114,492,750 lbs., from 698,044,517 lbs. in 1903 to 812,537,267 lbs. in 1904, and an increase in the net exports of 231,638,043 lbs., from 151,614,632 lbs. in 1903 to 383,252,675 lbs. in 1904. In other words, the enormous export trade absorbed not alone the increase in production, but 117,145,293 lbs. additional. Our domestic consumption, however, fell off in 1904 as compared with 1903, so that instead of drawing upon our stocks to the extent of the whole 117,000,000 lbs., we drew upon them only to the extent of about 56,000,000 lbs. The detailed study of the industry in the leading districts shows that a considerable increase in the production of copper will take place in 1905, unless some disturbance or catastrophe causes a general or partial cessation of work. It is difficult to estimate the quantity for the year, even assuming that normal conditions will prevail, because the new producers swing into line from time to time, usually at a belated date, and at a rate below the tonnage aimed at. The enlargements of old producers are subject to similar delays. But making full allowance for such causes, there is reason to believe that the production of 1905 will be larger by at least 75,000,000 lbs. than that of 1904, and that possibly a production of 900,000,000 lbs. may be reached. The consumption during the second half of 1904 developed on an enormous scale the world over, and the great requirements of the electrical industry and of the Russo-Japanese war are factors which must tell for a considerable time to come, the first named being of the greatest importance. A somewhat puzzling development has been the very large demand from China, which can not well be fully explained by the withdrawal of working forces from the Japanese mines, the usual source of supply, nor by the coinage requirements. It is widely believed that a considerable part of the purchases is on speculative account for Chinese merchants, whose accumulations will in any case flow slowly back into the channels of consumption.

THE DRIVER-HARRIS WIRE COMPANY, of Harrison, N. J., at a recent meeting elected Mr. F. L. Driver, president and treasurer; Mr. F. R. Harris, vice-president; and Miss M. C. Harris, secretary. The directors of the company are the officers, together with Mr. F. A. Driver, Mr. Jas. F. Bless and Mr. J. W. Howell. This company has just completed a new building to be used for offices, shipping room and stock room. At the same time, sufficient extra ground was bought adjoining upon which to erect another building for manufacturing steel wire. According to present plans, this additional improvement will be begun soon after Jan. 1. The company already has a plant of some magnitude, and with present and contemplated additions will rank with Harrison's largest manufacturing concerns. Among the various kinds of wire manufactured by this company are brass, copper and bronze for weaving purposes, electrical wire of all kinds for use in the making of various electrical apparatus and appliances, and "Hercules" tinned steel armature binding wire.

BIDS FOR NAVY YARD SUPPLIES.—Bids will be received until October 3 at the Bureau of Supplies and Accounts, Navy Department, Washington, to furnish at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; Norfolk, Va., and Charleston, S. C., electrical supplies, battery cells, and steel conduit; also October 10 to furnish at the navy yard at Pensacola, Fla., and the naval stations at Key West, Fla., and New Orleans, La., incandescent lamps and conduit fittings; also same date to furnish at the navy yard, New York, N. Y., and the works of the Fore River Shipbuilding Company, Quincy, Mass., the New York Shipbuilding Company, Camden, N. J., and the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., a quantity of electrical elevating, rammer and ammunition hoist equipments. Address H. T. B. Harris, Paymaster-General, U. S. N.

STANLEY-G. I. CO.'S NEW DEPARTMENT.—The Stanley-G. I. Electric Mfg. Co. has added another department to its plant at Morningside, Pittsfield, Mass., that of manufacturing jewels for instruments. Glass tubes for instruments are also made by the concern. The work in the foundry building has grown to large proportions, about 1,500 pounds of brass and aluminum casting being turned out daily. It is possible that the company will erect an iron foundry next spring, as it is now necessary to have all iron castings made out of the city. An officer of the company states that 85 per cent. more help are employed at present than last year, and that he expects to see the number increased to 1,500 by January 1.

ELEVATED AND SUBWAY LINES IN MEXICO.—S. S. Neff, formerly superintendent of the street railway system in the City of Mexico, is associated with a number of Americans and Mexicans in the project of building a system of elevated and subway electric lines for the City of Mexico. Application for a concession for the proposed system has been made to the Mexican government and is now under consideration by a commission of government engineers, who are investigating the project with a view of deciding as to its feasibility. Mr. Neff is at the Hoffman House, New York.

THE ROBINS CONVEYING BELT COMPANY has recently secured an order from the Orlando Water & Light Co., of Orlando, Fla., for a belt conveyor for handling wet muck. Among its other recent contracts are the order for a conveyor from the C. W. Hunt Co., of West New Brighton, and an order for five belt conveyors for the crushing plant of the Semet Solvay Company, Milwaukee, Wis.

BIDS FOR LIGHTING FIXTURES.—Bids will be received until October 3 by the Board of Health for furnishing material and installing electric and gas lighting fixtures in the administration and laboratory buildings and the scarlet fever pavilion on the grounds of the Willard Parker Hospital, Borough of Manhattan, New York City.

CONSOLIDATION OF WATER-TUBE BOILER INTERESTS.—A consolidation of much interest to the engineering world has just been consummated through the amalgamation of the water-tube boiler business of the Aultman & Taylor Machinery Company, of Mansfield, Ohio, and the Stirling Company, of Barberton, Ohio, as a result of which the Stirling-Cahall Boiler Company will be organized with a capital of $4,500,000. The position of the new company will be unique in that it will be able to supply to the trade practically every type of water-tube boiler, for in addition to manufacturing boilers of the Stirling, and Cahall horizontal and vertical types, it will shortly take up and place upon the market an improved water-tube boiler of the water-leg type. Details in respect to the organization of the company have not, as yet, been worked out, but it can probably be assumed that the consolidation will be one of organizations as well as of plants. They report business will be handled through the foreign connections of the Stirling Company in its offices in Johannesburg, S. A. R.; Havana, Buenos Ayres, Yokohama, the Hawaiian Islands, etc., as well as through its stock connection with the Stirling Boiler Company, Ltd., of Edinburgh, which is a prominent factor in the water-tube boiler business of Great Britain and the continent. The Stirling Company was organized in 1890, and in 1898 established its marine department, securing control of the United States patents on the Niclausse, Parrow and Mosher boilers. Its growth is illustrated in an increase of sales in eight years of nearly 800 per cent. The development of the Cahall sales department of the Aultman & Taylor Machinery Company has formed an equally important part at recent American industrial history. The new company thus starts with enviable prestige and with every facility for both manufacturing and selling. The general offices will be at 111 Broadway, New York.

POWER IN MINNESOTA.—B. L. G. Knox, vice-president and general manager of the Cucyrus Company, Milwaukee; F. O. Blackwell, consulting engineer of the Great Northern Power Company, Duluth; A. S. Slichter and B. W. Kirkpatrick, electrical and mechanical engineers for the General Electric Company, and C. C. Cokefair, of the Great Northern Power Company, spent several days recently, according to the *Iron Age*, in an extended trip over the Mesaba iron ore range inspecting conditions of steam shovel mining, etc. The General Electric and Bucyrus companies are now building at the Milwaukee shops of the latter company a large shovel to be operated electrically. The plan of these companies is to utilize the 25-cycle current of the Great Northern Power Company, to be generated at Duluth, for steam shovel service on the Mesaba range, and they propose to adopt the single-phase induction motor. The experiment will be watched with much interest. Work on the power company's project has so far advanced that it is now expected that current can be turned on by July next, at which time pole lines will have been constructed to carry the power to the Mesaba range, to Duluth and other adjacent points and to Minneapolis and St. Paul, which are about 130 miles from the generating station.

CUSTOM RULING.—In a decision by Thaddeus S. Sharretts the Board of United States General Appraisers have overruled a claim of the Weston Electrical Instrument Company, of Newark, regarding the rate of duty applicable to standard cells for electrical instruments. The Collector of Customs considered the cells to come under the provision in the Dingley tariff law for "blown glassware," with duty at the rate of 60 per cent. This classification was opposed by the importers, who set up the claim that the goods should be assessed at 20 per cent as unenumerated manufactured articles. This claim, as well as the classification imposed by the Collector, is deemed erroneous by the General Board. Mr. Sharretts says the cells should have been assessed as "manufactures of metal," with duty at the rate of 45 per cent ad valorem. Inasmuch, however, as the importers failed to make the proper claim in their protest, the board was unable to grant the relief.

OHIO BRASS COMPANY.—The Ohio Brass Company is rebuilding its factory, which was damaged by fire some months ago, at Mansfield, Ohio. There will be a one-story foundry, 106 x 266 feet; a machine shop, 60 x 340 feet, two stories high; a blacksmith shop and galvanizing building, 60 x 291 feet, and a warehouse, 76 x 150 feet. About 600 tons of structural steel will be used in the buildings. Special attention will be paid to fire protection, and a 125-foot steel stand pipe will be erected for use in connection with an automatic sprinkler system throughout the plant. The power plant will be enlarged to take care of the extensions. Mr. A. M. Allen, of Cleveland, is the consulting engineer.

TROLLEY ON LONG ISLAND.—The Manhattan and Long Island Railroad Company of New York was incorporated at Albany last week with a capital of $10,000,000. The purpose of the company is to operate an electric road eighty miles long in Greater New York and on Long Island, the terminals to be in Long Island City and at Northport. The directors are Edward Mackey, D. T. Meyer, H. H. Bowtell, Samuel Y. Sauber, Franklin M. Walter, George E. McArdle, New York; Robert M. Stockwell, Yonkers; A. Parontand, Brooklyn, and Henry Guinard, Watchung, N. J.

ANN ARBOR TROLLEY EQUIPMENT.—The Patrick Hirsch Company, of Toledo, has placed contracts for the power plant of the Toledo, Ann Arbor & Detroit Railway, operating an electric line from Toledo to Ann Arbor, Mich. The electrical equipment will be furnished by the General Electric Company; the steam equipment by the Arbuckle-Ryan Co., Toledo; the rolling stock by the Niles Car & Manufacturing Company, Niles, Ohio, and the rails by the Carnegie Steel Company. The road will be 50 miles long, and is to be ready by June 1, 1906.

APPARATUS WANTED.—Bids will be received until Nov. 1 by O. H. Ensign, electrical engineer U. S. Reclamation Service, Los Angeles, Cal., for furnishing complete, one or more alternating-current, 900-kw, 25-cycle generators, one or more 100-kw exciters, and a switchboard containing one panel for the generator and one panel for the exciter, for use in Roosevelt, Ariz., power house, of the Salt River project, in Arizona.

Financial Intelligence.

THE WEEK IN WALL STREET.—Bullish manipulation in the stock market was resumed and maintained during the week, and irregular advances were scored throughout the list, the United States Steel shares being among the chief features of the movement. Money advanced to 4 per cent. Bank clearings for the week ended with September 14 aggregate $2,530,675,996, 9 per cent over last week, and 17 per cent in excess of last year. Exchanges outside New York City total $930,223,333, 12 per cent over last week and 14 per cent above last year. On a fair business the traction stocks advanced, Brooklyn Rapid Transit closing at 69⅜, which is a net gain of 2¾, and Metropolitan Street Railway at 127⅞, a gain of 1¼. Interborough Rapid Transit closed on the curb at 216, a net loss of 1 point. The electric stocks also showed some firmness and all made gains. The Allis-Chalmers issues closed at 17¼ for common, a gain of ⅞-point, and preferred at 59, a net increase of 1½. General Electric made a gain of 2⅞ points, closing at 181⅞, and the last quotations for Westinghouse common and preferred were 169 and 180, respectively. American Telephone and Telegraph closed at 139 and Western Union at 95⅝. Electric Storage Battery is quoted at 85½, which was the lowest price for the week. The market for outside securities was, in the main, quiet and without special feature, but was generally firm in tone. The trading was mainly professional. Following are the closing quotations of September 19:

NEW YORK

	Sept. 12	Sept. 19		Sept. 12	Sept. 19
Allis-Chalmers Co.	17⅛	17¾	General Electric	179	180¾
Allis-Chalmers Co. pfd.	60	59¼	Hudson River Tel.	..	..
American Dist. Tel.	30	30	Interborough Rap. Tran.	215¾	215
American Tel. & Cable.	92	92	Mackay Cos.	40¾	41⅛
American Tel. & Tel.	139	139	Mackay Cos. pfd.	74	74¼
Brooklyn Rapid Transit.	67⅛	68⅝	Marconi Tel.	..	..
Electric Boat	30	30	Metropolitan St. Ry.	127	126¾
Electric Boat pfd.	65	70	N. Y. & N. J. Tel.	..	..
Electric Lead Reduction	..	..	Western Union Tel.	94	94¼
Electric Vehicle	19	18	Westinghouse com.	168	167
Electric Vehicle pfd.	23¼	23	Westinghouse pfd.	..	..

BOSTON

	Sept. 12	Sept. 19		Sept. 12	Sept. 19
American Tel. & Tel.	140¼	139	Mass. Elec. Ry. pfd.	59⅛	58⅛
Cumberland Telephone	120¾	120½	Mexican Telephone	1⅝	1⅝
Edison Elec. Illum.	..	250	New England Telephone	134	134½
General Electric	..	179	Western Tel. & Tel.	*18	*18
Mass. Elec. Ry.	15¼	15⅛	Western Tel. & Tel. pfd.	97	97

PHILADELPHIA

	Sept. 12	Sept. 19		Sept. 12	Sept. 19
American Railways	52⅛	52	Phila. Electric	8¾	8¾
Elec. Co. of America	11	11	Phila. Rapid Trans.	28	28
Elec. Storage Battery	85	85	Phila. Traction	..	..
Elec. Storage Battery pfd.	..	..			

CHICAGO

	Sept. 12	Sept. 19		Sept. 12	Sept. 19
Chicago City Ry.	190	190	National Carbon	60	60
Chicago Edison	..	..	National Carbon pfd.	*115⅛	115⅛
Chicago Subway	..	..	Union Traction	..	..
Chicago Tel. Co	..	..	Union Traction pfd.	..	..
Metropolitan Elev. com.	22⅝	25			

* Asked.

DIVIDENDS.—The directors of the Western Union Telegraph Company have declared the regular quarterly dividend of 1¼ per cent., payable Oct. 16. Directors of the Interborough Rapid Transit Company have declared a dividend of 2 per cent, payable Oct. 2. The Savannah Electric Company has declared a semi-annual dividend of $3 per share on the preferred stock, payable Oct. 2. The Seattle Electric Company has declared a semi-annual dividend of $3 per share on the preferred stock, payable Oct. 2. The United Gas Improvement Co. has declared a quarterly dividend payable October 14. The General Electric Co. has declared a regular quarterly dividend of 2 per cent, payable Oct. 16. The Westinghouse Airbrake directors have declared the regular dividend of 2½ per cent, and an extra dividend of 2½ per cent.

STREET CAR TRAFFIC IN PHILADELPHIA.—The report of the Philadelphia Rapid Transit Company for the year ending June 30, 1905, as presented to the stockholders at their annual meeting on Wednesday, September 20 shows that for the period named no fewer than 402,893,245 passengers were carried; an increase over the previous year of 12,360,556 passengers. The report of financial operations shows that the gross receipts from passengers were $6,188,645, an increase of $265,137. Deducting from the former amount the operating expenses of $8,183,437, there is left as earnings from operation the sum of $8,005,208, which, compared with 1904, is an increase of $75,015. Miscellaneous receipts, interests, etc., of $185,979, which sum is an increase of $13,124 over the previous year, make the gross earnings $8,191,188. Charging off against this licenses, taxes and fixed charges of $8,082,972, there is left as surplus the sum of $108,209, which is a decrease over the previous year of $112,639. In presenting the report to the stockholders, President Parsons called attention to the fact that the severe weather conditions of the past winter had helped materially to keep down the gross receipts of the company. He said that the total tracking of the system is now 554 miles, but during the past year there were added 28.72 miles. He also called attention to the construction of the Market Street Subway and said that at the present time the tunnel is practically completed to Sixteenth Street. The power equipment of the company has been increased by 6,000 kilowatts, all of which has been installed at the Second and Wyoming Avenue power house, and approximately ten miles of new conduits were laid during the year.

WESTERN UNION EARNINGS.—The quarterly statements of Western Union continue to reflect the loss of pool room business from which the company retired early in the fiscal year. There has been scepticism in some quarters, says the *Wall Street Journal*, as to the company's good faith in promising to cut out its connection with the pool rooms, but the promises made have been fulfilled and that department of the business has been absolutely closed up. The rooms in the Western Union Building at 195 Broadway, which were formerly devoted to the purposes of this department have been cleared of their instruments and are now being used for other purposes. As a result of this change earnings both for the September 30 quarter and for the fiscal year ending June 30 show considerable falling off as compared with the past few years, although it is understood that commercial business has been of satisfactory volume. For the fiscal year ending June 30, 1905, the company earned slightly in excess of 6 per cent. against the 5 per cent. dividend paid and in the quarter ending September 30, earnings amounted to only 1.6 per cent. against the quarter's dividend of 1¼ per cent. This is a pretty narrow margin, but the worst effects of the loss are now being shown.

SEATTLE-TACOMA POWER MORTGAGE.—In the matter of the recent filing of a mortgage on the property of the Seattle-Tacoma Power Company, as the basis for the issuance of $7,500,000 worth of 5 per cent, 20-year bonds, the underwriting was done by the Northern Trust Company, which is named as trustee in the instrument. The issue will be taken up by N. W. Harris & Co., of Chicago, from time to time as the power company calls for funds. The bonds are of $1,000 denomination, and are subject to redemption at 105 after June 1, 1909. It is stated that the purpose of the bonding was to systematize the miscellaneous debts of the concern, and also make possible large extensions of the business. In the pursuance of the first mentioned purpose approximately $2,000,000 of the issue will be used. The remaining indebtedness bonded by the present issue is that incurred by the nearly completed operations at Snoqualmie Falls, which will result in practically doubling the capacity of the plant.

KENTUCKY ELECTRIC CONSOLIDATION.—J. Levering Jones and J. M. Chandler & Co., of Philadelphia, have bought the several electric light plants and interurban railway properties in central Kentucky at a cost of about $10,000,000. The Lexington Street Railway & Light Company brought $2,000,000. The Blue Grass Traction Company got $1,400,000 for its two lines to Paris and Georgetown; the Central Kentucky Traction Company, $1,200,000 for its franchises to Versailles, Winchester and Richmond, and the Frankfort Railway & Light Company $300,000 for the plant at Frankfort and the franchise to Versailles. There are eleven miles in operation of the Frankfort and Versailles company and a fourteen miles franchise, not completed to Versailles.

CHESAPEAKE & OHIO.—The annual report of the Chesapeake & Ohio Railroad says: "The Covington & Cincinnati Elevated Railroad & Transfer & Bridge Company, controlled by C. & O., has acquired the ownership of the entire common capital stock of the Cincinnati Inter-Terminal Railroad Co., organized for transportation purposes within the city of Cincinnati. A connection is under construction between the bridge company's tracks and the Cincinnati, Hamilton & Dayton Railway, and additional tracks are also being provided. For this purpose it was necessary to authorize the issue of $1,000,000 preferred guaranteed stock of the Inter-Terminal Company, $700,000 to be issued at this time in payment for property and improvements and $300,000 reserved for future improvements. There is no bonded debt on that property."

CARBON COMPANY INCORPORATED.—The Independent Carbon Company, with a capitalization of $500,000, has been incorporated at Columbus, Ohio. This is the succeeding organization to the United States Carbon Company, which was purchased recently by M. B. Daly. The plant has been overhauled at an expenditure of about $100,000. The company will eventually establish branch plants in the gas belt of southeastern Ohio and West Virginia. B. P. Foster, manager of the United States Carbon Company, which was formed about eight years ago, will continue in the same capacity with the new company. The incorporators are Gustav Von Den Steinen, G. W. Cottrell, W. B. Stewart, H. E. French and John P. Dempsey.

TRACTION INTERESTS IN KENTUCKY.—A dispatch from Lexington, Ky., says that J. Levering Jones and P. M. Chandler & Co., of Philadelphia, have bought the several electric light plants and interurban railway properties in central Kentucky at a cost of about $10,000,000. The Lexington Street Railway and Light Company brought $2,000,000. The Blue Grass Traction Company got $1,400,000 for its two lines to Paris and Georgetown; the Central Kentucky Traction Company, $1,200,000 for its franchises to Versailles, Winchester and Richmond, and the Frankfort Railway and Light Company $300,000 for the plant at Frankfort and the franchise to Versailles.

OWENS RIVER WATER SYSTEM.—The bonds for the Owens River water system in California, have been voted, and engineers will soon be put in the field to make the surveys. The first actual construction work will be the installation of a power plant on Cottonwood Creek. The power will be carried along the line to drive drills, excavators, tunnel cars, etc. There will be about 900,000 feet of cement conduits, requiring 1,350,000 barrels of cement. The estimated cost of the tunnel work is $30 a foot. The estimates of the total cost stand: Cost of survey and water rights, $1,500,000; cement conduits,, $14,400,000; tunnels, $3,458,000; total, $19,358,000.

HUDSON RIVER POWER.—The report of the Hudson River Electric Power Company for July and the seven months ended July 31, compare as follows:

	1905.	1904.	Increase.
Gross earnings	$63,293	$42,771	$20,521
Operating expenses	37,405	21,529	15,876
Net earnings	25,887	21,242	4,644
7 months gross earnings	379,023	273,065	105,958
Operating expenses	230,170	149,139	81,031
Net earnings	148,853	123,926	24,927

MANILA SHANGHAI CABLE.—A certificate of increase of capital of the Commercial Pacific Cable Company of New York City from $12,000,000 to $15,000,000 has been filed at Albany with the Secretary of State. The company also filed an amendment to its certificate of incorporation providing that it may extend its lines from Manila to Shanghai. The certificates are signed by Clarence H. Mackay and Edward C. Platt.

PURCHASE OF RUTLAND PROPERTIES.—Mr. G. Tracy Rogers, of Binghamton and Buffalo, and Leo H. Wise, of the firm of Wise Bros., New York City, have it is stated, brought recently the public service corporations at Rutland, Vt., including street railway lines, electric and gas lighting plants and the water power franchise of Rutland.

LAKE SHORE ELECTRIC.—The final report of the Citizens' Savings & Trust Company, as receiver of the Lake Shore Electric Railroad Company has been filed in the United States Circuit Court at Cleveland. The report shows that $968,262 has been disbursed by the receiver, who turns over to the company $800,000 above all claims paid.

MORTGAGE TO SECURE BONDS.—The Toledo Gas, Electric & Heating Company has executed a mortgage for $2,500,000 on all its property in order to float a bond issue. The bonds are due October 1, 1935, and bear interest at 5 per cent. The instrument is in favor of the Ohio Savings Bank & Trust Company.

NORTHERN TRACTION.—Stone & Webster have purchased for about $2,000,000 controlling interest in the Northern Traction Company from the Bishop-Sherwin syndicate of Cleveland. The company owns a line from Dallas to Fort Worth, Tex.

MEXICAN LIGHT & POWER.—A dispatch from Montreal states that the Mexican Light & Power Company will increase its capital from $12,000,000 to $16,000,000 to permit important extensions being made.

General News of the Week

The Telephone.

GADSDEN, ALA.—The City Council has granted a franchise to W. H. Crumb and associates to erect a telephone system in this city. The rate for business houses will be $3.50 per month and for residences $1.75 per month.

STOCKTON, CAL.—C. C. Higgins has filed a new application for a telephone franchise with the City Council.

SANTA PAULA, CAL.—J. B. Titus and D. W. Mott have made an application for a telephone franchise. Notice of the sale of such franchise was ordered printed.

LOS ANGELES, CAL.—The San Diego Home Telephone Company now has 1,500 subscribers. All of its telephones are automatic. It connects with all Southern California points.

NEVADA CITY, CAL.—The Home Telephone Company, of Los Angeles, has applied to the trustees of this city and Grass Valley and to the county supervisor for a franchise.

MARTINEZ, CAL.—R. B. Borland has presented a communication from the Pacific States Telephone Company requesting permission to open streets for the purpose of installing an underground cable. His petition was granted.

SAN FRANCISCO, CAL.—The promoters of the Home Telephone Company, of San Francisco, say that they intend to spend about $1,000,000 in installing the system on the Oakland side of the Bay. The North Berkeley Improvement Club has sent the company an invitation to apply for a franchise in Berkeley.

OLNEY, ILL.—The Star Line Telephone Company of this place has been dissolved.

LINCOLN, ILL.—The City Council has granted the Central Illinois Telephone & Telegraph Company a franchise.

ALBION, ILL.—The Edwards County Mutual Telephone Company has increased its capital stock from $4,048 to $25,000.

SYCAMORE, ILL.—The De Kalb County Telephone Co., located at this place, has increased its capital stock from $100,000 to $150,000.

GLASFORD, ILL.—The North Star Telephone Company, of Glasford, has been incorporated for $2,200. The incorporators are Andrew Northrup, M. R. Turpin and C. W. Rusch.

SPRINGFIELD, ILL.—The Beloit Farm Telephone Company, located at Beloit, Wis., with a capital stock of $5,000, is licensed to transact business in Illinois with a state capital of $500.

KEWANEE, ILL.—The Kewanee Long Distance Telephone & Telegraph Company has been formed; capital, $100,000. The incorporators are: William I. Hibbs, Frank M. Ashe, Archie C. Shoemaker.

CHICAGO, ILL.—The Chicago Telephone Company in its bid has offered to supply police and fire telephones to the city at a rental of 50 cents per set. The bid was for 1,600 receivers, 1,552 transmitters, 1,210 induction coils and 150 portable stand telephones.

DUNLAP, ILL.—The Dunlap and Alta Telephone Company has held its annual meeting, at which time the following officers were elected: President, Dr. Walter Allen; secretary and treasurer, W. D. Chas. Threshie; directors, Joseph Robinson, Austin Shaw and Charles Holmes.

SHELBYVILLE, ILL.—The Mutual Telephone Company has just been organized by prominent business men of Tower Hill, Ill. A number of farmers are arranging to attach party lines, and will have connection with the entire county. The officers of the new company are: President, E. G. Foster; vice-president, Dr. A. C. Jackson; secretary-treasurer, J. C. Pitzer; manager, L. B. Fluckey; directors, E. G. Foster, John Jenkins, Dr. J. R. Young, Dr. A. C. Jackson, L. B. Fluckey, R. Shride and J. C. Pitzer.

ALTON, ILL.—The City Council was notified September 9 by officials of the Central Union (Bell) Telephone Company, that the company had a perpetual franchise in Alton. The city officials were about to proceed against the company to compel it to pay 2 per cent. of its gross earnings to the city treasury as a consideration for a renewal of its franchise, which was supposed to have expired. Investigation was started when the company claimed a perpetual franchise, and it was found that the old ordinance granting a franchise gave no stated time for the life of the permit. According to the old franchise the company has a perpetual right. An attempt will be made by the city to have the franchise declared void.

RICHMOND, IND.—The Central Union Telephone Company will not be allowed to lay conduits in the streets of Richmond until the other companies using wires are prepared to do likewise.

INDIANAPOLIS, IND.—The Central Union Telephone Company is making a strong effort to secure the long-distance telephone business in some of the southern counties of Indiana. Arrangements have been made to connect Bloomfield, Bloomington, Nashville and Columbus via Calvert Station, and it is said that Spencer and Ellettsville will also be connected. The Bloomfield-Columbus line will give the Central Union Company a direct connecting line across the southern part of the state.

LAKE PARK, IA.—Local business men contemplate a competing telephone exchange.

CONRAD, IA.—Charles Hurd has recently purchased the telephone exchange at this city.

INTERNATIONAL FALLS, IA.—The Council has granted a franchise for a telephone system to the International Telephone Company.

LE MARS, IA.—The capital stock of the Le Mars Telephone Company has been increased from $50,000 to $100,000 and the name changed to the Plymouth County Telephone Company.

BURLINGTON, IA.—The new line of the American Telephone and Telegraph Company is nearing completion. This line extends from Burlington to Kansas City and points in the southwest. An additional through line from Galesburg to Burlington will be completed within a week or ten days. One from Keokuk to Burlington is nearing completion. All of these circuits enter the office of the Iowa Telephone Company.

STUBBLEFIELD, KY.—The Citizens Telephone Company has been formed with a capital of $500 by H. A. Walston and H. I. Batts.

PADUCAH, KY.—The People's Independent Telephone plant was sold by the United States Commissioner on Sept. 11 to close a mortgage for $252,000, held by Wilkesbarre, Pa., banks. It was bought in by E. L. Barber, of Wauseon, O., for $80,000.

ROWE, MASS.—The Heath Telephone Company has bought out the Rowe Telephone Company, and will take possession October 1.

BAY CITY, MICH.—Within a few days the Michigan State Telephone Company will have in service nearly 50 rural telephones west of the city. The new line is completed to Auburn and takes in many farmers along the road.

SLEEPY EYE, MINN.—The Sleepy Eye Telephone Company will build a rural line to Prairieville.

CLEAR LAKE, MINN.—The Sherburn County Telephone Company has secured a franchise to build an exchange here and also one at Becker.

RUTHTON, MINN.—The Ruthton Telephone Company has been incorporated by Geo. Bingham, president, and N. C. Bertelson, secretary.

NEWTON, MISS.—The Board of Mayor and Aldermen of Newton has granted a franchise to E. E. Grassett and J. J. Mott, Jr., of Meridian, to establish and operate an independent telephone system here. The same people are interested in several private lines that connect with towns adjacent to Newton, and they will also have connection with the Home Telephone Company at Meridian.

FARMINGTON, MO.—The Farmington Telephone Company was sold by T. P. Pigg to local capitalists for about $60,000. The system is one of the largest in Missouri, outside of the large cities, having switchboards at Farmington, Flat River, Bonne Terre and Deer Run.

TRENTON, N. J.—The United States Independent Telephone Company has been incorporated here by Henry A. Bingham, Richard F. Tulley and Robert S. Carmichael, of Jersey City. The capital stock is $100,000.

FULTON, N. Y.—The Fulton Common Council has granted the Empire State Telephone and Telegraph Company permission to place its wires in electrical subways. The company was also authorized to construct lines over the surface of the streets.

LEXINGTON, N. C.—A new telephone company has been chartered here.

ROSEHILL, N. C.—The Rosehill Telephone Company has been chartered with $10,000 capital stock. This company was referred to in last issue in these columns.

BOLIVAR, OHIO.—The Imperial Home Telephone Company certifies to an increase of capital stock from $10,000 to $40,000.

CINCINNATI, OHIO.—The Big Four Railroad will extend its system which was installed between Cleveland and Galion and between Galion and Bellefontaine eight months ago. It is now the plan to install telephone service over the telegraph wires from Galion on to Cincinnati, also from Springfield to Sandusky.

BELLEVUE, OHIO.—Frank A. Knapp, of this place, has purchased a controlling interest in the local telephone company and the Bellevue Home Telephone Company. The local telephone company has 4,200 telephones installed and 200 miles of toll lines in Huron and Crawford counties, with exchanges in sixteen towns. With Mr. Knapp are asociated some of the leading independent telephone men in the state. By the deal Knapp and his associates acquire control of telephone property representing an investment of over $400,000.

WILLOE, OKLA.—The Willoe Telephone Company has been formed with a capital of $1,000, by L. C. Cousins and J. W. Berry.

GUTHRIE, OKLA.—The Quay Rural Telephone Company has been organized. Capital, $200,000. Incorporated by O. F. Hutchinson and C. M. Prowvant.

PORTLAND, ORE.—The Independent Telephone Company has sold $1,000,000 worth of bonds, the money to be used in the construction of a long-distance line between Portland and British Columbia cities.

EAST VANDERGRIFT, PA.—East Vandergrift has granted a franchise to the Vandergrift Telephone Company.

NEWTOWN, PA.—At a meeting of business men of Newtown borough a local telephone company was formed, with a capital of $5,000. Edward P. Hicks has been selected president of the new company and J. Herman Barnsley secretary and treasurer.

PITTSBURG, PA.—It is expected that the Keystone Telephone Company, of Philadelphia, will join the movement for the merging of the independent telephone companies and will take part in forming a trunk line between Pittsburg, Philadelphia and New York.

WILKESBARRE, PA.—At a meeting of the board of directors of the Consolidated Telephone Companies of Pennsylvania, held at Allentown, an order was placed for a new toll board section for the Wilkes-Barre exchange. This company has also just recently installed the two party selecting ringing system.

YORK, PA.—The capital stock of the York Telephone Company has been increased from $200,000 to $500,000. The fund realized by the increased stock will be applied to placing the wires of the company's system in the city underground, to extend rural lines and make a variety of improvements for the betterment of the service.

BRISTOL, TENN.—The Holston Valley Telephone Company has been organized at Holston Valley, this county, with the following officers: David McConnell, president; J. D. Thomas, vice-president; Philip Painter, secretary and treasurer.

KNOXVILLE, TENN.—The East Tennessee Telephone Company, in the near future, will install a central energy switchboard in the Knoxville exchange building, and other improvements to the service in this city will be made.

RIPLEY, TENN.—A stock company has been organized for the purpose of building a telephone line from Halls, twelve miles north of Ripley, by way of Nankipoo to Edith. Application for a charter has been filed in the Register's office at this place, the capital stock being placed at $1,500. The incorporators are J. H. Bibb, G. N. Grear, L. F. Adams, E. Abernathy and A. B. White.

SAN ANTONIO, TEX.—A new telephone line is to be built from this city to Bandera.

EL CAMPO, TEX.—The Coast Telephone Company has been organized at El Campo with a capital stock of $5,000. T. J. Poole is one of the incorporators.

SHERMAN, TEX.—At a meeting of the directors of the recently organized North Texas Telephone Company, held in this city, final arrangements were made for the construction of the proposed line from this city to Gainesville via Southmayd, Pottsboro and Woodbine.

LEANDER, TEX.—The Block House & Leander Telephone Company has been organized to operate the telephone line which runs from Leander to Block House. A. Bittick is president and L. F. Chapman secretary of the new company. The line will probably be extended.

SAN ANTONIO, TEX.—It is stated that the Commercial Telephone Company, which was recently sold by order of court to pay off its bonded indebtedness, will be reorganized and placed upon a solid footing. This company operates about 500 miles of long-distance telephone lines in Texas. The company has filed suit against H. M. Aubrey, of San Antonio, a director of the company, for $77,000 damages, said to have grown out of the alleged overbonding of the plaintiff company. Mr. Aubrey has brought suit against his co-directors in the courts of Ohio, where they reside.

LLANO, TEX.—The Martin Telephone Company, which recently increased its capital stock from $10,000 to $20,000 and changed its principal office from Johnson City to Llano, has made arrangements to either build new lines or connect with other companies' lines from Mason to the San Angelo Company's line at Menardville, and from San Saba either Comanche or Brownwood, to form a junction with the Roberts Independent Telephone Company at Midland, Tex., and the Riddle independent telephone system at Weatherford, Tex. Among the stockholders of the Martin Company are Otto Ebeling, M. H. Reed, R. H. Evans, all of Marble Falls, Tex.; David Martin, of Llano, and Levi Crownover, of Blanco, Tex.

SALT LAKE CITY, UTAH.—Articles of incorporation of the Eastern Utah Telephone Company, with a capital stock of $60,000, have been filed. The purpose of the company is to connect the towns of Carbon and Emery counties by the construction of about 125 miles of local line and afterwards deal with the Independent or the Bell Company at Salt Lake for Utah and other connections. R. G. Miller, a local capitalist, will probably hold a majority of the stock.

HARTWOOD, VA.—The Hartwood and Fredericksburg Telephone Company, with headquarters at Hartwood, has been chartered, with $4,000 capital, by P. W. Irvin, of Falmount, secretary and treasurer, and several others.

PETERSBURG, VA.—The Petersburg Telephone Company has been granted the privilege of laying its wires underground in the business section. An ordinance has also been passed by the aldermen requiring telegraph companies to place their wires underground.

SEATTLE, WASH.—Bonds aggregating $1,000,000 in value are now being circulated in the East by the Independent Telephone Company, of this city, to provide for the extensions to the local and outside service. It is the intention of the company to absorb a number of smaller companies and to carry its lines into the State and Northwest.

BELOIT, WIS.—The Beloit Farm Telephone Company has been incorporated, with a capital of $5,000.

GREEN BAY, WIS.—The consolidation of the Valley Telephone and Telegraph Company, of this city, and the Fox River Valley Telephone Company, of Appleton, has been perfected. J. S. Van Nortwick is president; J. P. Hoeffel, secretary.

MILWAUKEE, WIS.—Albert von Hoffman is the promoter for the telephone company which has introduced an ordinance in the common council, being the third to ask for a franchise to establish an independent telephone, in competition with the local Bell telephone system. The company will ask for a franchise under the title of Registering Telephone Company. The ordinance of the West Shore Telephone & Telegraph Company, and the Milwaukee Home Telephone Company have been the subject of several hours' discussion before the Council.

TORONTO, CAN.—A combination of municipalities and independent telephone companies and manufacturers has been formed for the purpose of fighting the Bell Telephone Company and securing favorable legislation from both the Provincial and Federal Parliaments. About fifty delegates were in attendance, representing private corporations, excepting Mayor Urquhart, who was chosen to preside. Mr. A. F. Wilson, of Markham, was elected secretary. Committees were appointed to draft a constituion and resolutions.

Electric Light and Power.

ALBERTVILLE, ALA.—A number of the business men of Albertville have organized the North Alabama Railway, Light & Power Company, with a capital of $100,000. The purpose of the company is to connect all Sand Mountain towns with an electric railway, provide water works for the larger towns and to light the towns with electricity. J. G. Elrod is president, N. A. Elrod vice-president and business manager, and W. M. Coleman, secretary.

STOCKTON, CAL.—The Middle River Navigation & Canal Company expects to install a number of electrically driven pumps, and purchase ditching machinery.

SAN FRANCISCO, CAL.—The Union Light and Water Company has been incorporated with a capital stock of $2,000,000 by Richard Kirman, John Humphreys, Jos. Martin, M. Fleishhacker, F. H. Buck, R. E. Wallace and H. A. Cooke.

RIALTO, CAL.—The Edison Electric Company has made a proposition to the citizens of Rialto to extend the 10,000-volt line from San Bernardino, the Rialto citizens to establish their own local operating company, furnish wires, meters, transformers, etc.

SAN FRANCISCO, CAL.—The Vancouver Power Company, Ltd., which transmits electric power 16 miles from its plant on Burrard Inlet, is about to place orders for an additional generating unit of 1,500-kw. capacity. The present installation includes three 1,500-kw., 3-phase generators, each direct-connected to a 3,000-hp. A Pelton water wheel operating at 225 r.p.m., under 390-ft. head will be installed. The headworks are arranged to admit of operating five units.

SAN FRANCISCO, CAL.—The Truckee River General Electric Company's new brick sub-station, near the C. & C. Works, Virginia City, Nev., has been completed. It has a capacity of 3,000 kw. in static transformers. There are six 250-kw. and four 675-kw. transformers, used for stepping down from 24,000 to 2,200 volts. The company's second power plant, on the Truckee River, is nearly completed and will be in operation in time to supply current at Virginia City under its new contract with the Comstock Pumping Association in October.

SAN FRANCISCO, CAL.—The Oro Water, Light & Power Company has received bids, through Cory, Meredith & Allen, engineers, for its initial generating plant. The power site is about 15 miles from Oroville and an available head of 480 ft. of water will be utilized. Water will be taken from the Oroville Light & Power Company's extensive system of ditches, which connect with the West Branch of the Feather River. The tail water from the plant will go into the secondary ditch system, supplying domestic water for Oroville and water for mining and irrigating purposes. J. W. Goodwin, San Francisco, is prominent in the management of the company.

SAN FRANCISCO, CAL.—Engineer Noerager, from the General Electric Company's work, is in San Francisco, superintending the installation of the new sub-station equipment in the United Railroads electric power house at 16th and Bryant Streets. This plant is to be remodeled and most of the old generators removed. Motor-generators sets, taking current from the California Gas & Electric Corporation system, will furnish direct current for use on the street railway lines. Before reaching this sub-station, the current will pass through frequency changers at the gas engine reserve plant of the California Gas & Electric Corporation, being changed from 60 cycles to 25 cycles.

SAN FRANCISCO, CAL.—The Union Light & Water Company, which has been incorporated here by Joseph Martin, Mortimer Fleishhacker, John Humphreys and others, amounts to a consolidation of the electric power and water interests operating in and around Reno, Nev. The capitalization is $2,000,000 and it is understod that arrangements have been made to place bonds amounting to about $700,000. The power plants of the Washoe Power & Development Company and the Reno Power, Light & Water Company will be taken over by the new management. A good deal of land and valuable water properties are included in the acquisitions. The power lines tie in with those of the Truckee River General Electric Company, so that whenever necessary current can be transmitted to Viriginia City and the Comstock Mines.

SAN FRANCISCO, CAL.—The two 800-hp. Westinghouse induction motors for the latest pumping plant for the Comstock Pumping Association, at Virginia City, Nev., will soon arrive at their destination. They cost about $25,000 delivered. They are especially constructed, it being necessary to make each frame in four pieces so as to be lowered down the shaft. The motor and pump have a common steel shaft 14 ins. in diameter and 14 ft. long, the cranks being forged on. The combined weight of the two motors is 110,000 lbs. The speed will be 195 r.p.m., which is slow for an induction motor, but fast for the two direct-connected Knowles crank and flywheel pumps. The pumping plant will be installed in a chamber 80 ft. long, 24 ft. wide and 20 ft. high. It will take the Reidler pumps two months to lower the water sufficiently for the new pumps to be installed. Then the chamber must be cut in the rock and it will probably be six months before the installation is completed. Leon M. Hall, engineer for the Comstock Pumping Association, will have charge of the work.

ROCKMART, GA.—About $5,000 has been raised here for an electric light plant. R. R. Beasley is the moving spirit in the enterprise.

JACKSON, GA.—The city of Jackson has voted a bond issue of $40,000, to be used for an electric light and water works system for the municipality.

TALLULAH FALLS, GA.—Louis B. Magid, of Tallulah Falls, has purchased the water power of the same name at Tallulah Falls, and may develop electric power. The available energy is about 35,000 horse-power.

WASHINGTON, GA.—It is stated that Capt. J. H. Fitzpatrick, of Washington, has purchased the Anthony Shoals property in this county and will develop and transmit this power to Washington, Elberton and Anderson, S. C., and build a railroad from Washington to Elberton.

WEISER, IDAHO.—The Swan Falls Light & Power Company has petitioned for a franchise to light the city.

CUBA, ILL.—A new 150-hp. simple automatic engine and a 100-kw., single-phase, 125-cycle alternator are to be installed in the municipal plant. L. Monch is superintendent.

GREENFIELD, IND.—The street lighting system here, which is owned by the city, will be changed to the alternating-current system.

JASONVILLE, IND.—The Jasonville Electric Company will soon ask bids for constructing an electric light plant here. Jas. H. Parsons is president.

VALPARAISO, IND.—The Valparaiso Lighting Company has been formed; capital, $150,000; incorporated by Clarence H. Geist and Charles B. Kelsey.

SUMMITVILLE, IND.—The injunction obtained two years ago by taxpayers of this city to prevent the town trustees from making the first payment on a municipal light and water plant has been dissolved by Judge Lefler, of Muncie, and the city must pay the price, $55,000. The ground for the complaint was that second-hand material was used in the construction and there were evidences of graft.

LEBANON, IND.—The Citizens' Electric Light & Ice Company, Lebanon, Ind., has installed two Diesel engines, one of 400 hp. and the other about 200-hp. capacity. The larger of the two engines was employed at the St. Louis Exposition for furnishing light and power for the Tyrolean Alps, on the Pike. Each engine is direct connected to a General Electric alternator of corresponding size.

MARSHALLTOWN, IA.—The Council has authorized the Water and Light Committee to make repairs to the lighting plant. Two new dynamos are needed.

FORT LEAVENWORTH, KAN.—Bids will be received until Oct. 4 by Capt. J. E. Normoyle, Constructing Quartermaster, U. S. A., for extending the electric lighting system at Fort Leavenworth.

ASHLAND, KY.—The Virginia Light & Power Company has been incorporated with a capital of $25,000, to construct an electric lighting system from Richmond, Va., to Ashland.

DEXTER, ME.—The Dexter Electric Light Company has sold its plant and business to N. Curtis Fletcher, of Boston.

WATERVILLE, ME.—The Massalouskee Electric Company contemplates constructing a new water power station on Rice Rips, to cost about $125,000.

PORTLAND, ME.—The Citizens' Water & Lighting Company has been incorporated; capital, $230,000. Promoters. A. F. Pine, H. L. Cram and C. E. McGlauflin, Portland.

HYATTSVILLE, MD.—A committee has been appointed to report on the construction of a municipal electric light plant. Harry W. Shepherd is chairman of the Light Committee.

BRUNSWICK, MD.—The Brunswick extension of the Harpers Ferry Electric Light & Power Company has been organized at Brunswick by the election of the following directors: Dr. H. S. Hedges, Mr. J. T. Martin, Mr. C. R. Gregory, Mr. William Schnauffer, Mr. G. T. Hogan, Mr. H. M. Jones, Mr. F. E. Adler and Z. T. Brantner.

BALTIMORE, MD.—Upon the complaint of the Consolidated Gas, Electric Light & Power Company and the filing of a bond for $5,000, an injunction has been granted by Judge Stockbridge, in Circuit Court No. 2, restraining the Maryland Telephone & Telegraph Company from interfering with the poles and wires of the Consolidated Company on Broadway, between Baltimore and Thames Street, and from stringing any of its own wires on the poles in question.

WALTHAM, MASS.—The new power house of the Waltham Gas & Electric Light Company, in course of construction, will be one of the largest houses outside of Boston. It will cover an area of 150 feet by 100 feet. The building will be 35 feet high and fireproof. The contract calls for the building to be completed, the plant installed and in operation by Jan. 1, 1906.

UXBRIDGE, MASS.—In accordance with a vote of the town at the March town meeting the selectmen have concluded a five-year contract with the Uxbridge & Northbridge Electric Company for lighting the streets of the town. According to the new contract the town is to pay $14.50 per year for each incandescent and $63 per year for each arc light. The former price was $15 and $70 respectively.

ADDISON, MICH.—The contract has been awarded to the Western Electric Company, of Chicago, for the installation of a municipal lighting plant in the village.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Electric Company expects to deliver power in Grand Rapids by Jan. 1. It has contracted with a number of Muskegon firms to supply them with power.

STURGEON FALLS, MICH.—The Penn Iron Mining Company, with lands on both sides of the Menominee River, has completed plans for utilizing the power of the river. A dam is to be erected at once, and 2,400 horsepower will be available. This power will be used for the operation of mining machinery.

GRAND RAPIDS, MICH.—Representatives of the M. B. Wheeler & Co. of this city have filed 15 entries of lands on the Manistee River in Manistee County. It is understood that the rapids of the river will be utilized for the generation of electric power which will be transmitted to Manistee. The Wheeler company has secured franchises in Manistee and in other cities. The Wheeler company is constructing a dam on White River from which it will furnish power to Muskegon.

GRAND RAPIDS, MICH.—Although the city of Grand Rapids is in the municipal lighting business, it pays annual tribute to the Grand Rapids Edison Company approximating $1,500 and the Grand Rapids Gas Light Company, approximating $2,000 for light and power furnished to various departments of the city. This revenue is to be cut off by the plans of manager of the Public Works Department, who will see that the city generates light and power for its own use.

BIG TIMBER, MONT.—The Big Timber Electric Light & Power Company has petitioned for a franchise for water works and an electric light system.

VIRGINIA CITY, MONT.—The Butte Electric Light & Power Company, of Butte, has petitioned for a franchise to furnish this city with electric light and power.

LIVINGSTON, MONT.—The Livingston Water Power Company has begun the erection of a new power house, 60 x 100 feet, two stories high. Foundation will be provided for 4,750 kw in generators and four 1,315-hp turbines. At the start there will be installed a 1,750-kw General Electric generator and a 1,325-hp Leffel water wheel.

NEVADA, MO.—The Nevada water works, gas plant and electric light system and street car lines have been purchased by J. M. Gore, of Jerseyville, Ill., who has assumed possession of the properties. The plants are consolidated.

ST. LOUIS, MO.—Paul D. Cable, president of the General Service and Development Company, of Webster Groves, has been granted a franchise to carry on the electric business of the West St. Louis Water and Light Co., which he recently purchased.

CLINTON, MO.—Proposals to furnish light and water for the city of Clinton will be accepted until Oct. 17 by the water and light committee. Dr. S. T. Neill is chairman. The franchise of the present water company expires in a short time, also the city lighting contract.

ATLANTIC CITY, N. J.—A disinterested authority says there is little probability of a new company being started in Atlantic City in opposition to the Electric Company of America. Among other reasons, the season is short, the expense of a new plant large, and that the city lighting, for which the Electric Company of American has a 10-year contract, is a large portion of the business.

SYRACUSE, N. Y.—Bids will be received until September 25 by the Board of Contract and Supply, for lighting the city for one, two, three, four or five years; also price for incandescent lighting for all city buildings and the maximum price for incandescent lights for private consumers.

ROCHESTER, N. Y.—An application of the Niagara Falls Electrical Transmission Company for a franchise to use the streets of Rochester to construct conduits and to conduct an electrical business in this city has been made. Particularly interesting is the information that the Niagara, Lockport & Ontario Power Company's route takes it around the city rather than through it.

NORTH TONAWANDA, N. Y.—The Niagara Falls Electrical Transmission Company has withdrawn its application for a franchise in North Tonawanda on account of conditions attached by the Common Council. The particular demand which caused the company to withdraw was that it pay 2½ per cent. of its gross receipts to the city. Another proposition held in reserve, though not offered, was that the company be required to furnish 5,000 horse-power within three years.

LOUISBURG, N. C.—The Town Council of Louisburg has appointed a committee to negotiate for the establishment of a municipal lighting plant.

MOORESVILLE, N. C.—The town commissioners of Mooresville have been negotiating with parties desiring to establish an electric lighting plant.

CHARLOTTE, N. C.—The Catawba Power Company reports that there is a greater demand for power than it can readily fill at this time, and new machinery is being installed as rapidly as possible to complete, within a few months, the immediately available power for transmission.

TIFFIN, OHIO.—The Tiffin Electric Illuminating Company has contracted with the Aultman-Taylor Company for a 450-hp boiler, which is soon to be installed at the power house.

TOLEDO, OHIO.—A proposition to bond the city for $470,000 to equip a municipal lighting plant will be voted upon by the electors of Toledo at the regular election Nov. 7. It must have a two-thirds vote to carry.

PLYMOUTH, OHIO.—Contracts for water and light plant have been awarded as follows: Engine and pumps to Strong, Carlisle & Hammond Company, for $4,015, and electrical equipment to the Fort Wayne Electric Works, of Fort Wayne, Ind., for $1,119.

CANTON, OHIO.—The Merchants' Light, Heat & Power Company, of Canton, has begun work on a new power and heating plant. Contracts have been placed with the Arbuckle-Ryan Company, Toledo, for the steam and electrical equipment.

SALEM, OHIO.—The Beam Engineering Company, Electric Building, Cleveland, acting for Cincinnati interests, has purchased the Salem Electric Light & Power Company. It is the intention to install new equipment in the power station and practically rebuild the plant. The Beam Company will superintend this operation.

TOLEDO, OHIO.—The Toledo Gas, Electric & Heating Company, the concern that recently merged the heating and lighting companies of the city, has decided on the location for a new light plant. It will be located next to the Detroit Avenue station of the Yaryan factory. The contract has been awarded to the H. J. Spieker Company for the new building, which will be 120 feet square and constructed of armored concrete. The first stockholders' meeting of the company was held in the office of King & Tracy. Officers and a board of directors were elected. The officers are: President, William F. Robison; first vice-president, James S. Brailey, Jr.; second vice-president, Lawrence Pierce, of St. Louis; treasurer, J. K. Secor; assistant treasurer, L. B. Beckwith; secretary, Frank W. Caughling; assistant secretary, Edgar C. Hampton. The capitalization of the new company is $2,500,000, and bonds to the extent of $2,500,000 will be issued. This is a consolidation of the Toledo Heating & Lighting Company, Toledo Gas Light & Coke Company, and the Citizens' Gas Light Company.

ANDERSON, S. C.—The Hatton Shoals Power Company has been organized at Anderson with $150,000 capial. It proposes to generate electric power on the Tugalee River, 16 miles from the town, for a number of cotton milling plants about Anderson.

The Electric Railway.

SAN FRANCISCO, CAL.—The Napa & Lakeport Railway Company has been incorporated in this city with a capital stock of $2,000,000. E. C. Amadee and A. J. Brown, of this city, and F. W. Ansell, of Alameda County, are the incorporators.

WILMINGTON, DEL.—Talk of building an electric railway from Wilmington, Del., to Newark, and thence to Oxford, in this county, has been revived, several capitalists being interested in the movement.

GEORGETOWN, GA.—The Wynyah Traction & Power Company, which proposes to build an electric railway to Georgetown, a distance of six miles, has been commissioned. The capital stock is $50,000, and ultimate capital of $100,000. The incorporators are J. B. Steel, W. W. Taylor, E. W. Kaminski, W. H. Andrews, L. Mouzen, all of Georgetown.

EVANSVILLE, IND.—The Evansville City Council has granted a franchise to the Evansville & Mt. Vernon Traction Company.

ANDERSON, IND.—The Indiana Union Traction Company will soon begin the construction of a new and more direct line from Jonesboro into Marion.

BLOOMINGTON, IND.—The Indianapolis & Ohio Valley Traction Company and the Wabash & Southwestern Company are seeking franchises in this city.

MARION, IND.—John Ratliff, of this city, has asked the commissioners of Grant County for a franchise for an electric railway to run from Marion to Noblesville, which is to connect there with another line proposed to run to Indianapolis.

EAST ST. LOUIS, ILL.—At the meeting of the incorporators of the East St. Louis, Waterloo & Chester Suburban Railway Company, James S. Slade was elected president, A. B. Garrett secretary, and E. F. Schoemring, of Columbia, treasurer.

SPARTA, ILL.—The City Council has passed the water works and telephone ordinance asked for by the St. Louis capitalists and T. M. Jenkins, Harry B. Hawes, James McCaffrey and George J. Kobusch, of St. Louis, have given notice that they will present for passage at the next regular meeting of the City Council ordinances for a street railroad, gas and electric lights.

MT. STERLING, KY.—The Blue Grass Traction Company will shortly begin the building of a 25-mile electric railway from Paris to Mt. Sterling. The road will connect with the Maysville line to Paris.

ATCHISON, KAN.—An amended charter has been applied for by the Atchison Railway, Light & Power Company, which increases the capital stock of the company from $300,000 to $900,000. Under the charter, the company will have the right to construct and operate interurban lines to Leavenworth, St. Joseph, Topeka, Horton and Hiawatha. These interurban lines are a matter for the future.

HAGERSTOWN, MD.—The Hagerstown & Waynesboro Electric Railway Company has been incorporated with a capital stock of $100,000. Operations are to be carried on in conjunction with another corporation just formed in Pennsylvania to handle the Pennsylvania end of the business. The directors of the company are Mayor A. C. Strite, D. Clayton Gilbert, Walter D. Willson, Dr. E. A. Wareham and John W. Feldman, all of Hagerstown.

BOSTON, MASS.—The Boston & Northern and the Old Colony Street Railway Companies have each petitioned the Railroad Commissioners for authority to issue $200,000 capital stock. In April last these companies increased their respective capital stocks by $500,000, bringing the outstanding stock of the Boston & Northern Company up to $10,160,000, and that of the Old Colony Company to $7,312,400. The proposed increases are to pay for extensions and additions to the equipment of the companies.

SEDALIA, MO.—A certificate of incorporation has been granted to the Central Railway Company, of Sedalia. The capital stock is $1,000,000.

MARSHALL, MO.—The City Council has granted the Central Electric Railway Company right of way to locate and operate an electric railway through the city. The line proposed will run from Sedalia north to Miana.

LANSING, MICH.—The Council has let the contract for fifty alternating-current arc lamps to the Adams-Bagnall Company of Cleveland. This is the first step in the change of city lighting system from the direct to the alternating. Seven companies furnished proposals.

MONROE, MICH.—The Detroit, Monroe & Toledo Short Line Electric will probably build a branch to Dundee from this city, a distance of 15 miles. Free right of way for a distance of seven miles was guaranteed by one farmer and Dundee will grant a franchise and give a free site for an auxiliary power house.

KALAMAZOO, MICH.—The West Michigan Railway Company has filed articles of incorporation and will succeed the West Michigan Traction Company in the project for the building of 85 miles of trolley line from Benton Harbor to Kalamazoo, with branch lines. B. L. Brown, an eastern capitalist, has bought the right of way and organized the new company.

BATH, N. Y.—Representatives of the Rochester & Eastern Railway Company propose to construct an electric line between the Flower City and Elmira.

SYRACUSE, N. Y.—The Auburn & Syracuse Construction Company has been incorporated with $25,000 capital to carry on improvements planned for the Auburn & Syracuse Electric Railroad.

NEW YORK, N. Y.—The Manhattan and Long Island Railroad Company has been incorporated to operate an electric road 80 miles long in Greater New York and Long Island, the termini to be in Long Island City and at Northport; capital, $10,000,000. The directors are Edward Mackey, D. T. Meyer, H. H. Bowtell, Samuel Y. Sauber, Franklin M. Walter, George E. MacArdle, New York; Robert M. Stockwell, Yonkers; A. Parontand, Brooklyn; Henry Guinard, Watchung, N. J.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern Railroad Company has been incorporated at Albany with a capitalization of $2,500,000, to take over and operate the old Syracuse, Lakeside & Baldwinsville Railroad, between Syracuse and Baldwinsville, which is to be extended to Fulton and Oswego. The directors are: H. S. Holden, C. M. Warner, A. K. Hiscock, C. D. Beebe, William Nottingham, W. A. Holden, W. K. Pierce, Edward Joy, L. C. Smith, J. S. Gray, A. R. Peck, H. C. Beatty and C. B. Benson.

NEW YORK, N. Y.—At a meeting of the Board of Estimate and Apportionment of the City of New York, held last week, the application of the New York & Port Chester Railroad Company for a franchise to construct that portion of its line within the limits of the city of New York, about ten miles, which is necessary for the completion of its system, was unanimously granted and the controller was directed to prepare the ordinance as required by law. This action of the Board of Estimate and Apportionment completes the last legal step of the Port Chester Railroad, and gives it a complete set of franchises and charters through all the towns and cities lying between the Harlem River and the Connecticut state line.

PINEHURST, N. C.—The electric railway from Southern Pines to Pinehurst has been bought by the Aberdeen and Asheboro Railroad. It is not known what disposition will be made of the property by the new owners.

GREENSBORO, N. C.—The Greensboro Electric Company is reported to have contracted with the American Suburban Corporation to build an electric railway through the property of the above named land concern near Greensboro.

ALLIANCE, OHIO.—The Alliance, Akron & Cleveland Railroad Company has been formed by Hugh Bleakley, of Alliance. He proposes to build a line from Alliance to Akron, where connection will be made for Cleveland.

GALLIPOLIS, OHIO.—Capt. John C. Shepard is securing right of way for an electric line from Gallipolis to Point Pleasant and Pomeroy. He claims to have ample capital to put the project through. He has applied for franchises in Gallipolis.

NEWARK, OHIO.—The Newark & Mount Vernon Traction Company has been incorporated by S. C. Morse, F. A. Crane, A. H. Wilson, Dwight Sapp, F. L. Beam and others. The initial capital is $10,000. The line will extend from Newark to Mount Vernon, touching Utica and Gambier.

CAMBRIA, PA.—The Blair & Cambria Street Railway Company has filed notice of intention to apply for a charter. The proposed incorporators are H. P. Wilson, F. D. Wray, W. S. Lee, W. B. Douglass, F. J. Thompson, James Malone and F. G. Patterson.

HARRISBURG, PA.—A charter has been granted at the State Department to the Hagerstown & Waynesboro Street Railway Company, capital $25,000, to build a line over the Waynesboro, Maryland & State Line Turnpike and private right of way from Mason and Dixon's line, to Waynesboro. The directors are: W. A. Morgart, Cumberland, Md., president; J. A. Strite, Jacob S. Lesher, W. Towmake, Jno. W. Fieldman and Roderic Clary.

HARRISBURG, PA.—The directors of the Pennsylvania Traction Company have selected Mason D. Pratt, of Harrisburg, Pa., as the engineer to make the plans for the new power house in South Harrisburg and to superintend its erection. The new power plant will be erected on the site of the old car barns erected by the East Harrisburg Passenger Railway Company about twenty years ago on South Cameron Street, and will adjoin the present plant acording to the statements of officers of the company. The present plant will supply the power until the new one is completed, which will be early in 1906.

ALEXANDRIA, TENN.—The Alexandria Street Railway is constructing a new line. G. W. Borde, of New Orleans, is superintending the work.

NASHVILLE, TENN.—Four large automobiles have been purchased by R. H. Boyd, president of the Penny Savings Bank, of Nashville, for use in a bus line here for negroes. A company recently incorporated here as the Union Transport Company, with a capital of $25,000, is organized and owned by negroes, and will be run in the interest of negroes in competition with the local street car lines, because of the "Jim Crow" law.

CORSICANA, TEX.—The Board of Trade of Corsicana is considering a proposition for the construction of an interurban electric railway from Corsicana to Palestine.

PALESTINE, TEX.—The City Council has received an application from the representative of local capitalists for a franchise to build and operate an electric railway in this city. The franchise will probably be granted.

OLYMPIA, WASH.—Two railway companies have filed articles of incorporation with the secretary of state. The Puyallup Valley Traction Company, with a capital stock of $250,000, and headquarters at Puyallup, has announced the object of building a railway from Puyallup to Tacoma. The incorporators are: Fred. J. Chamberlain, W. D. Cotter and W. H. Elvins. The other company is the St. Helena Public Service Company, with headquarters at Castle Rock. It purposes to build a line of railway from that town to the St. Helena mining district, thence to a point on the Columbia River in Clarke County, thence to the place of beginning, with a bridge or ferry across the Columbia and a line running south to Portland. The company also announces its intention of engaging in electric lighting, etc. The capital stock is placed at $1,000,000, and Henry W. Coe, L. O'Connor and Joseph O'Neil are the incorporators.

PACHUCA, MEX.—The Pachuca & Real del Monte Railway system is to be converted into an electrically operated line and otherwise improved. Engineer B. M. de Arozarena, the owner of the system, is now in New York, arranging the details of the transaction.

SANTA ROSALIA, MEX.—It is stated that the material to be used in the construction of the electric street railway system in this city has been ordered in the United States. Paul Ginther, who is promoting this enterprise, is also organizing a company in Europe to take over a concession acquired by him from the Mexican Government for the erection of a large electric power plant on the Conchos River above Santa Roslia. This company will have a capital stock of $5,000,000. The proposed power plant will furnish electrical energy for operating the electric street railway system in Santa Rosalia. Power will also be transmitted to Parral and other towns of the State.

CHIHUAHUA, MEX.—It is announced that J. W. Conger, brother of Hon. E. H. Conger, former ambassador to Mexico, who recently obtained an option on the street railway system and electric light and power plant in Chihuahua, is meeting with success in organizing a company of Americans to take over these properties. The street railway system will also be extended by its new owners.

New Industrial Companies.

THE SCHMIDT-WILCKS ELECTRIC COMPANY has been incorporated at Weehawken, N. J., with a capital of $100,000. The incorporators are Lambert Schmidt, Felix Wilcks and Ferdinand Wilcks.

THE SHELBY SAFETY SWITCH COMPANY, of Shelby, Ohio, has been incorporatord by W. R. Cochran, Jr., C. J. Edwards and others. The capital is $10,000. The company will manufacture switches and other railroad devices.

THE AMERICAN ELECTRICAL REPAIR COMPANY, of Pittsburg, Pa., has been formed to specialize in the repairing of electrical machinery of all kinds. The officers are: R. Zeringer, president; Thos. McCreary, vice-president, and H. A. Rife, general manager.

Legal.

ATTACKING TELEPHONE FRANCHISE.—Information in quo warranto was filed in the Circuit Court, Chicago, last week, by State's Attorney Healy and Corporation Counsel Lewis against the Chicago Telephone Company. The company is asked to show why it should continue as a corporation. Misuse of franchise is alleged, and violation of the city ordinances. The petition attacks the "grounded service" system of the company, the toll rates between points within the city limits and the alleged excessive rate for business telephones. An ordinance in 1889 fixed the rate for business telephones at $125 a year. The company charges $175 a year.

Personal.

WALTER H. WHITESIDE.

MR. WALTER H. WHITESIDE, recently elected president of the Allis-Chalmers Company, joined that organization in July, 1904, when he accepted the position of general manager of sales. He came at a time when the company, which had just taken over the Bullock Electric Manufacturing Company, needed the injection of a vigorous and energetic personality into its sales force. It was not merely that he had to become familiar with all the intricacies of the company's widely varied products, but the new interests and the old had to be consolidated, the sales organization enlarged and its efficiency increased. His promotion to the presidency indicates with what success Mr. Whiteside has met in his efforts. In taking up this higher and more responsible position, Mr. Whiteside has behind him not only the confidence of his organization, but a long and varied business experience, in which he has filled many executive positions. His achievements have won him recognition as a man of marked administrative ability. Mr. Whiteside is a member of the American Institute of Electrical Engineers, of the Engineers' and Lawyers' Clubs of New York, of the Mid-Day Club, Chicago, and of the Milwaukee Club.

MR. C. V. ASPINWALL, general manager of the Mississippi Valley Telephone Company, has resigned. His place has been taken by Mr. A. C. Reid, chief electrical engineer of the company.

MR. ERNEST A. REGESTEIN has resigned his position as instructor in electrical engineering at Lehigh University to accept a position in the general sales department of the Standard Underground Cable Company, at Pittsburg, Pa.

MR. J. B. COWEN.—The General Storage Battery Co., New York City, has secured the services of Mr. J. B. Cowen (formerly prominently connected with the General Incandescent Arc Light Company) for the management of its sales department.

MR. U. N. BETHELL, general manager of the New York Telephone Company, has just left on a trip to Europe, where he will enjoy a much needed vacation and rest. The system has now something like 220,000 telephones, and is growing at the rate of over 4,000 subscribers a month, reflecting vigorous and effective management.

CAPT. LEONARD D. WILDMAN, who recently returned from Alaska, where he had charge of the wireless telegraph system operating between St. Michaels and Fort Davis at Nome, has been made chief signal officer of the Department of California, with headquarters in San Francisco. In the face of great difficulties Capt. Wildman established and maintained very good wireless communication between the two places, 125 miles apart. His achievements in the field of wireless telegraphy have won him great distinction.

EUGENE HOLCOMB.

MR. EUGENE HOLCOMB has been appointed manager of the newly created foreign department of the Allis-Chalmers Company, which includes supervision of all the foreign agencies and foreign selling representatives of the company. In this position, Mr. Holcomb will supervise the work of the established European and South African offices, and all Eastern Hemisphere agencies, but he will have direct control over the South and Central American business for the company. With the engineering possibilities and projects in South America Mr. Holcomb is thoroughly familiar, having spent a number of years in that hemisphere. The past three years he has had immediate charge of the Westinghouse companies' interests in Argentina, with headquarters in Buenos Aires. Under his supervision was designed and installed the great gas power plant of the Southern and Western Railroads of Argentina, including the complete gas producer plant, manufacturing gas from bituminous slack. These complete power plants operated entirely by gas and installed at an aggregate cost of upwards of a million dollars, supply not only power for operating the machinery in the immense railroad shops, but through underground cables transmit power ten miles to operate the cranes and ship-loading devices at the docks of the railroad company, marking a step in advance of any gas power plant up to date. Mr. Holcomb received his early training in the steam engine and electrical industry on the Pacific Coast and Middle West, and sold his electric light and contracting interests in Illinois to take up foreign work with the Westinghouse companies. His knowledge and experience in the engineering fields of this country, and the engineering projects he has carried through abroad, make Mr. Holcomb a valuable acquisition to the Allis-Chalmers Company. His headquarters will be at the general offices of the company at Milwaukee, Wis.

DR. F. S. PEARSON.—A big game preserve is being prepared in Southern Berkshire by F. S. Pearson, the street railway engineer, who has been buying farms in the southern section of Berkshire; and it is understood that when all preparations have been completed the estate will be stocked with game. The farms lie in Alford, Hillsdale and Austerlitz and up to date comprise some thousand or more acres. The view obtained from portions of the farms cannot be equalled in this section. Much of the property is heavily wooded.

MR. T. A. EDISON, according to rumors circulating at Gardner, Mass., may establish a manufacturing plant there. This is what the local *News* says: "Less than a week ago, the inventor and his party stopped over at the Templeton Inn, and while there, it is alleged that parties in Gardner, who have land which they are desirous of disposing of, met him by appointment on business. The great inventor and his party also stopped over at Fitchburg, and it is stated that while there he consulted with parties in relation to procuring a suitable site for a factory in the vicinity." Other towns in the State have still to be heard from.

MR. W. G. CARLTON, formerly of the Chicago Edison Company, has just been appointed superintendent of power of the electrical zone of the New York Central & Hudson River Railroad Company. In this capacity Mr. Carlton will have charge of the two main electric power stations which the company is building near New York, the eight substations and the transmission system. He will report to the electrical department. Mr. Carlton, who is a native of Warren, Ill., graduated from Cornell University in the class of 1892. He was one year in the General Electric student course at Lynn, and then went to the Chicago Edison Company, advancing from the construction department and draughting room up to his present position of assistant to the chief operating engineer.

MR. A. J. LATHOUSE.—A. J. Lathouse, who has been superintendent of the Columbus Citizens' Telephone Company, tendered his resignation recently in order to carry out his plans of organizing a construction company to build a series of telephone exchanges in Ohio and to construct in addition to these electric light plants in various towns in the State. Mr. Lathouse has been with the Citizens' Telephone Company since its infancy and constructed its first subway. For seventeen years he has been engaged in the telephone construction business, having built fifteen exchanges in Franklin County. Mr. Lathouse says that there is a great opporunity awaiting the man who could gather the capital and launch this undertaking. Not only in the telephone exchange construction is the field lying open, but also in the erection of electric light plants in the smaller towns throughout Ohio.

Trade Publications.

EXHAUST STEAM.—Warren Webster & Company, Camden, N. J., have issued a pamphlet describing the Webster system of steam circulation for heating purposes. The details of this system are fully treated in booklet F. 20 and in the general catalogue of the company.

TRANSFORMERS.—Bulletin No. 72 of the Wagner Electric Manufacturing Company, St. Louis, is devoted to standard lighting and motor transformers. The internal construction of the transformers is well shown by numerous illustrations, while the operating features are described at length.

MACHINE WRENCHES.—The Billings & Spencer Company, Hartford, Conn., has issued an illustrated booklet dealing with drop-forged machine wrenches. These wrenches are of the milled, semi-finished and finished types and are furnished in the international, metric and Whitworth standards.

STEAM HEATING.—The Monash-Younker Company, 203 South Canal Street, Chicago, Ill., is sending out an effective trade publication in the form of an illustrated folder dealing with the Monash automatic air valve for steam radiators. The advantageous features of this device are presented in an attractive manner.

REGISTER FOR EMPLOYEES.—The Universal Register Company, 88 Centre Street, New York, has issued a circular dealing with the "in-and-out" register. This register is for use in clubs, and all classes of retail as well as wholesale mercantile establishments, and in places wherever it is desirous of recording the absence or attendance of employees.

SPARK COILS FOR GAS ENGINES.—The Autocoil Company, Jersey City, N. J., has recently issued a loose-leaf catalogue dealing with various types of ignition coils, gas engines. The vibrators are of the compound, single-spring, double-spring or bow-spring type. Each type of "Autocoil" unit is illustrated, and the prices of the various parts are indicated.

SINGLE-PHASE MOTORS.—The paper by Mr. G. Percy Cole on "Recent Developments in Single-Phase Alternating-Current Motors," which was read before the Ohio Electric Light Association Convention, August 16, 1905, as noted in our columns at that time has been reprinted and is now being distributed by the Wagner Electric Manufacturing Company, St. Louis, Mo.

LIGHTING TRANSFORMERS.—The numerous improvements which have been made recently by the Fort Wayne Electric Works, Fort Wayne, Ind., in the design of the coils of Type A transformers are treated in detail in bulletin No. 1067. The coils are subdivided in order to allow a large surface to be presented to the cooling oil and to insure a low reactance drop in the coils.

DULUTH AERIAL BRIDGE.—With regard to the Duluth aerial bridge, described in our pages last week, it may be stated that a handsome and admirably written little booklet on the subject has recently been prepared under the supervision of the city engineer's office, for general information, and issued and published by the City of Duluth. Mr. Norton Mattocks saw this creditable brochure through the printing office.

COMBINED VOLTMETER AND FREQUENCY INDICATOR.—The Wagner Electric and Manufacturing Company, St. Louis, Mo., has issued bulletin No. 73, dealing with a combined voltmeter and frequency indicator, which is provided with two scales, one reading "volts" and the other "cycles." The frequency indicator is useful in paralleling two generators, as the instrument will indicate the frequency of the incoming machine, and used in connection with lamps, or a phase indicator, the paralleling of generators becomes a simple matter.

STEEL SHEET PILING.—The United States Steel Piling Company, 135 Adams Street, Chicago, Ill., has issued an illustrated catalogue devoted to steel piling. This piling has a plain rolled section ready for use as it comes from the mill. Each pile is uniform in strength, interlocking, interchangeable and complete in itself. Numerous views are given of the piling as actually installed. A folder, which accompanies the catalogue, contains a complete description of the steel sheet piling used with the 18-story extension of the Tribune Building, Park Row, New York.

SERIES ALTERNATING-CURRENT LIGHTING SYSTEM.—Bulletin No. 1070 of the Fort Wayne Electric Works, Fort Wayne, Ind., it is devoted to the Wood system of lighting by means of series arc lamps. The regulator, which is used to keep the current at a constant value, consists of a reactance coil and core movable with respect to each other. The reactance coil and core are connected with levers in such a manner as to balance each other, one end of one lever being connected to the coil while the other end of the same lever is connected with the iron core. The bulletin describes the operation of the regulator as that of a choke coil of varied reactance. Both the switchboard and the lamps are likewise discussed fully as to constructional details and operating features.

BALANCED COMPOUND LOCOMOTIVES.—A recent booklet of the Baldwin Locomotive Works, Philadelphia, gives a reprint of a paper read before the Richmond Railroad Club by Lawford H. Fry, on "Notes on the Principles and Performance of the Balanced Compound Locomotive," together with an article from the *American Engineer* on "Instructive Tests of a Baldwin Balanced Compound Locomotive," and an article on "Counterbalance for Balanced Compound Locomotives," by Mr. Fry, which appeared in the *Railroad Gazette*, June 9, 1905. A table is given to show that in comparison with a single-expansion locomotive, a balanced compound locomotive can be built with 25 per cent. more heating surface and 40.6 per cent more effective horse-power, with an increase in weight of only 3 per cent. It is stated that at high speeds, the hammer blow in a two-cylinder engine balanced in accordance with the best practice, may amount to 40 or 50 per cent of the pressure of the wheel on the rail when at rest. The elimination of the hammer-blow in the balanced compound makes this locomotive very much easier on the track and bridges than a single-expansion locomotive of the same weight.

ALTERNATING ARC LIGHTING SYSTEM.—Bulletin No. 7036 of the Western Electric Company, 259 South Clinton Street, Chicago, describes the numerous features of the Western Electric system of series enclosed alternating arc lighting. The system consists of a transformer, a regulator and enclosed arc lamps. The primary windings of the transformer are in two sections which may be connected either in series or in multiple, according to the primary voltage for which the system is to be operated. Numerous taps are provided on the secondary so that the voltage may be varied to conform to the number of lamps in operation. The laminated iron core of the regulator is composed of three vertical limbs cross connected at the upper end, and supported upon rigid uprights attached to an iron sub-base. The reactance coil is mounted below the core. It is stated that the regulator can be adjusted to maintain the current to within 0.1 of an ampere under any load. Each lamp is designed to act as a regulator and helps to maintain a constant current. The voltage across the arc and the current through the arc are regulated by the mechanism of the lamp, so that a change in current is taken care of by the lamps as well as by the regulator. The bulletin describes the mechanical details of the lamps, and treats of the various accessories for the arc lighting system.

News of the Trade.

T. A. MULLOWNEY, formerly connected with the Leominster Electric Light & Power Company, has opened a store in Leominster, Mass., under the firm name of the Leominster Electric Company. He will trade in all kinds of electrical work.

THE AMERICAN ARC LAMP COMPANY, successor to the Lea Electric Manufacturing Company, of Elwood, Ind., is now located in a new factory at Kalamazoo, Mich., and invites orders from old friends and prospective customers, for the filling of which it now has adequate facilities.

THE VIADUCT MANUFACTURING COMPANY has just patented a portable, or pocket telephone, which will prove a most convenient outfit for many purposes. The fire department of Baltimore has been using this pocket telephone exclusively with much satisfaction. It will be found useful almost anywhere, and inspectors of telephone exchanges should find it indispensable.

THE ROCK ISLAND DRY BATTERY COMPANY, of Rock Island, Ill., is seeking a building in Cincinnati which will provide from 12,000 to 15,000 feet of floor space. The company is controlled by Mayer Loeb, president and general manager, and by M. S. and H. C. Rosenthal, of the firm of H. Rosenthal & Sons, Cincinnati. The company has recently acquired control of patents on dry batteries.

THE CRESCENT ELECTRICAL MANUFACTURING COMPANY, Rochester, N. Y., manufacturers of panel boards, knife switches, switchboards, cutouts and branch blocks, has recently reorganized and increased its capital stock. This was made necessary by the increase of business, and to include its new manufactures. It is fully equipped with up-to-date machinery and have more than double the size of its factory. It is particularly competent to take care of orders for panel boards, as one of the foremost experts in the line is in charge of this department.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 12, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

798,790. ELECTROLYTIC PROCESS; Carl Hering, Philadelphia, Pa. App. filed Sept. 5, 1905.

798,906. STORAGE BATTERY; Alfred E. Knight, Somerville, Mass. App. filed Nov. 16, 1904.

798,920. METHOD OF REDUCING OXALIC ACID AND ITS DERIVATIVES BY ELECTROLYSIS; Emil von Portheim, Prague, Austria-Hungary. App. filed Jan. 29, 1904.

799,035. REVERSING MECHANISM FOR MOTORS; Abe L. Cushman, Concord, N. H. App. filed May 31, 1904. A reversing switch controlled by an electro-magnet, is actuated each time the rheostat controller is thrown to the off position, so that the motor will always start up in a reverse direction.

799,049. LIGHTNING-ARRESTER; Peter Cooper Hewitt, New York, N. Y. App. filed May 16, 1902. (See page 530.)

799,050. CIRCUIT CONTROLLER; Peter Cooper Hewitt, New York, N. Y. App. filed Mar. 7, 1903. (See page 530.)

799,051. VAPOR CIRCUIT-BREAKER; Peter Cooper Hewitt, New York, N. Y. App. filed Mar. 20, 1903. (See page 530.)

799,052. CIRCUIT-CONTROLLER; Peter Cooper Hewitt, New York, N. Y. App. filed Aug. 10, 1903. (See page 530.)

799,053. METHOD OF CONTROLLING ELECTRIC CIRCUITS; Peter Cooper Hewitt, New York, N. Y. App. filed Aug. 10, 1903. (See page 530.)

799,061. ELECTROLYTIC APPARATUS AND ELECTRODES THEREFOR; Carl Kellner, Hallein, Austria-Hungary. App. filed July 7, 1896.

799,064. PNEUMATIC OR HYDRAULIC TRANSMISSION OF ELECTRIC POWER; Hans Kowsky, Hastings-Upon-Hudson, N. Y. App. filed Sept. 5, 1902. A piston is thrown from one position to another by electro-magnetism and thereby forces air through a system of conduits to a second piston which actuates a railway switch signal or other device.

799,105. REVOLVING ELECTRIC FURNACE; Ernesto Stassano, Rome, Italy. App. filed Apr. 9, 1902. (See page 531.)

799,106. CONDUIT POLE; Frank Stevens, Philadelphia, Pa. App. filed June 27, 1904. A specific form of joint for the pole or rod used to thread a conductor through a conduit.

799,110. COVER FOR THIRD RAILS; William G. Taylor, Forest City, Pa. App. filed Dec. 3, 1904. The cover consists of ceramic material applied over a T rail in such a manner that air passages are left between the cover and the rail to protect the latter from excessive changes in temperature.

799,135. SWITCH; Antoine Benassy, Geneva, Switzerland. App. filed Dec. 17, 1904. Details.

799,137. TRANSMITTER-ARM; Jules A. Birsfield, Rochester, N. Y. App. filed Feb. 13, 1905.

799,146. CIRCUIT-CHANGING APPARATUS; Merritt S. Conner, Chicago, Ill. App. filed Mar. 17, 1904.

799,160. SWITCHING APPLIANCE FOR TELEPHONE-EXCHANGES; Carl M. Hedman, Chicago, Ill. App. filed May 22, 1902.

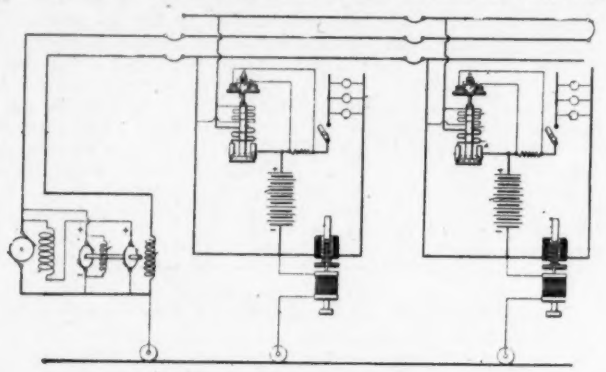
799,177. POWER-TRANSMISSION SYSTEM; Victor Martinetto, Chicago, Ill. App. filed Feb. 18, 1904. Two induction motors with their rotors mechanically connected together, have their secondary windings joined in series and so placed mechanically that the currents in one secondary produced by the voltage of the other will give tongue in the desired direction on account of its mechanical position with reference to the primary field.

799,183. JUNCTION BOX; Ludvig H. Nielsen, New York, N. Y. App. filed Jan. 16, 1903. The box is intended to be inserted in a partition, and its faces are extensible or telescoping with respect to the body to fit different thicknesses of partition.

799,191. ELECTRICAL ATTACHMENT PLUG; Bert E. Salisbury, Syracuse, N. Y. App. filed July 20, 1904. A metallic cap for protecting the base of the plug is provided with a fibre lining, the edges of which project into an annular groove in the cap to hold it in place.

799,205. TELEPHONE-RECEIVER CASING; Axel R. Thollander, Chicago, Ill. App. filed Nov. 10, 1904.

799,213. TROLLEY CATCHER AND RETRIEVER; Charles F. Wilson, New York, N. Y. App. filed Jan. 24, 1905. A spring drum, pawl and ratchet arrangement.



799,526.—Lighting System.

799,218. PROCESS OF DEPOSITING METAL ON NON-METALLIC BODIES; Cassius F. Blacklidge, Washington, D. C. App. filed Jan. 14, 1905.

799,219. ELECTRIC INCANDESCENT LAMP HAVING SECOND-CLASS CONDUCTORS; Wilhelm Boehm, Berlin, Germany. App. filed June 23, 1900. (See Current News and Notes.)

799,237. TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed April 6, 1905. The transmitter sends to line groups varying in length and sequence of short, rapid current alternations, and the receiving relay is located in a balanced separate circuit which is connected inductively with the main circuit.

799,238. SEXTUPLEX TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed Apr. 7, 1905. A sextuplex arrangement of apparatus, consisting of three relays, one or more of which are polarized, and associated transmitting system, including a pole changer, an ampere changer, and a controller of short and rapid alternating current impulses; also means whereby signals are rendered neutral upon the home relay system, a separate circuit for one relay, and means for inductively connecting the relay with the main and artificial lines.

799,239. TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed Apr. 19, 1905. Modification of the preceding systems patented by the same inventor.

799,240. TELEGRAPHY; Sterns F. Jones, New York, N. Y. App. filed Apr. 21, 1905. A further modification.

799,245. SELF-PROPELLED VEHICLE; Hermann Lemp, Lynn, Mass. App. filed Mar. 31, 1904. (See Current News and Notes.)

799,305. MAGNETO ELECTRIC GENERATOR; Robert C. Crouch and John A. Titzel, Sr., Newcastle, Pa. App. filed Nov. 19, 1904. The armature of the generator consists of a number of magnetic balls which may be given a certain amount of movement, causing fluctuation of the current in the circuit that may be felt by connecting the terminals of the circuit to parts of the body.

799,346. CALLING DEVICE FOR AUTOMATIC TELEPHONE-EXCHANGES; Frank A. Lundquist and John K. Norstrom, Chicago, Ill App. filed Aug. 27, 1900.

799,358. ROSETTE; Albert P. Seymour, Syracuse, N. Y. App. filed Feb. 26, 1903. A one-piece rosette having side passages through which the lamp cord passes in order to take its weight from the terminals.

799,377. CUT-OUT FOR ELECTRIC HEATERS; Johannes Harden, Schenectady, N. Y. App. filed Dec. 1, 1904. A fluid receptacle having an electric heater applied thereto and a cut-out for the heater actuated when the heat of the fluid rises above or falls below a predetermined point.

799,392. TELEGRAPH TRANSMITTER; William H. Leonard, Mount Vernon, and Joseph H. Lewis, New York, N. Y. App. filed Dec. 14, 1904. In this transmitter the keys when pressed downward rotate disks having segments in their peripheries variously spaced to send signal impulses over the line.

799,402. ELECTROPLATING APPARATUS; Louis Potthoff, Brooklyn, N. Y. App. filed Apr. 30, 1904.

799,410. REFRIGERATOR DRIP PAN; Charles E. Smith, Morris Park, N. Y. App. filed Apr. 30, 1904.
pan to give notice when the pan is full of water.

799,419. TROLLEY; William S. Tichenor, Owensville, Ind. App. filed Feb. 4, 1905. Details.

799,420. LAMP SOCKET; Julius C. Tournier, Schenectady, N. Y. App. filed Nov. 27, 1903. Details.

799,423. TRANSFORMERS; William L. Waters, Milwaukee, Wis. App. filed Apr. 28, 1905. The core and coils are placed in a vessel of oil and surrounded by cooling coils through which a circulation of air is maintained.

799,433. SUPPORT FASTENER FOR LIGHTNING CONDUCTORS; Carl Bajohr, St. Louis, Mo. App. filed Mar. 29, 1905. The fastener has a foot extending below its lower surface and projections extending outwardly from the body thereof to assist in holding it in position in a wall.

799,441. PROCESS FOR PURIFYING TANTALUM METAL; Werner V. Bolton, Charlottenburg, Germany. App. filed Oct. 12, 1904.

799,451. STARTING APPARATUS FOR VAPOR ELECTRIC LAMPS; Clyde J. Coleman, Rockaway, N. J. App. filed Feb. 7, 1904. (See Current News and Notes.)

799,452. RELAY; William W. Coleman, Edgewood Park, Pa. App. filed Apr. 7, 1905. An interlocking relay comprising electro-magnets and co-acting armatures, and an interlocking device operative upon the movement of the armature of one of the electro-magnets to lock the armature of the other electro-magnet.

799,516. TRAIN LIGHTING SYSTEM; William L. Bliss, New York, N. Y. App. filed Apr. 27, 1904. This patent and those that follow in the same name, describe a system of car lighting, comprising a single generator and storage battery adapted to supply all the lamps throughout a train, and a controlling device whereby the generator will maintain a substantially constant voltage, notwithstanding the removal of one or more cars or units from the train or the variations of the number of lights in the circuit.

799,517. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Jan. 30, 1905. (See brief of patent, No. 799,516.)

799,518. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Mar. 18, 1905. (See brief of patent, No. 799,516.)

799,519. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, New York, N. Y. App. filed July 17, 1905. (See brief of patent, No. 799,516.)

799,520. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Apr. 24, 1905. (See brief of patent, No. 799,516.)

799,521. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Mar. 15, 1905. (See brief of patent, No. 799,516.)

799,522. LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed June 15, 1904. (See brief of patent, No. 799,516.)

799,523. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Mar. 15, 1905. (See brief of patent, No. 799,516.)

799,524. TRAIN LIGHTING SYSTEM; William L. Bliss, Brooklyn, N. Y. App. filed Mar. 15, 1905. (See brief of patent, No. 799,516.)

799,525. TRAIN LIGHTING SYSTEM; William L. Bliss, Brooklyn, N. Y. App. filed Mar. 15, 1905. (See brief of patent, No. 799,516.)

799,526. LIGHTING SYSTEM; Wm. L. Bliss New York, N. Y. App. filed June 16, 1904. (See brief of patent, No. 799,516.)

799,527. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Apr. 24, 1905. (See brief of patent, No. 799,516.)

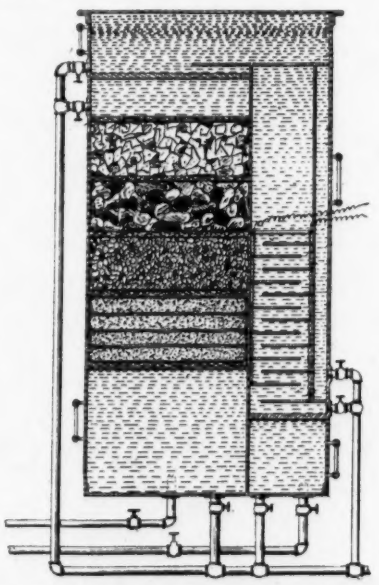
799,528. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Apr. 24, 1905. (See brief of patent, No. 799,516.)

799,529. TRAIN LIGHTING SYSTEM; Wm. L. Bliss, Brooklyn, N. Y. App. filed Apr. 24, 1905. (See brief of patent, No. 799,516.)

799,530. REGULATING SOCKET; Louis F. Bogia, Jr., Philadelphia, Pa. App. filed Apr. 25, 1904. A lamp socket having a resistance which may be varied by turning the usual key.

799,554. TELEPHONE-RELAY; Bela Gati, Budapest, Austria-Hungary. App. filed Feb. 9, 1904.

799,555. TELEGRAPHY; Bela Gati, Budapest, Austria-Hungary. App. filed May 9, 1904. Apparatus comprising a coherer containing a small gap having a fluid between its terminals, ionizing means adapted to constantly act on the fluid in the gap, but with insufficient intensity to produce ionization, and means whereby electric waves may be made to act on the fluid in the gap for producing ionization.



799,605.—Apparatus for Electrically Purifying Water.

799,567. MULTIPLEX TELEGRAPHY; George L. Hogan, London, England. App. filed Aug. 11, 1902. The main feature consists in placing the transmission line in repeated connection with three contacts at one station and three corresponding contacts at another, by means of a synchronizing current consisting of a series of alternately positive and negative electric impulses separated by zero periods, the positive impulses effecting one contact, the zero period another, and the negative impulses, the third.

799,585. ELECTRIC GENERATOR FOR TELEPHONE SYSTEMS; Enos B. Willix and John Young, Mount Vernon, Iowa. App. filed Feb. 25, 1905.

799,605. APPARATUS FOR ELECTRICALLY PURIFYING WATER; James F. Lester, Atlanta, Ga. App. filed Nov. 28, 1904. An apparatus comprising an electrolytic water treating chamber, an ozonizing chamber and a filter in a single casing, the electrolytic chamber and ozonizing chamber being totally surrounded by water to prevent the heating of the water being treated.

799,613. MOTOR ATTACHMENT FOR LINOTYPE MACHINES; Melvin W. Morehouse, Brooklyn, N. Y. App. filed Jan. 10, 1905. A bracket adapted to be quickly secured to the frame of the machine without alteration of the latter.